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AUTHOR Goddard, Ruth; And Others

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ABSTRACT

This publication is a resource for those who teach basic mathematics to adults. It assumes very little knowledge or formal mathematics by teachers, tutors and students and provides background, strategies and rationale for people inexperienced in teaching adult numeracy as well as new ideas for the experienced teacher. The worksheets and activities have been especially designed for adults and the language used is suitable for students with low level literacy skills. The book is divided into six sections: Getting Started; Exploring Numbers; Addition and Subtraction; Multiplication and Division; Money and Metrics; and Fractions and Percentages. The materials and methods used in this book encourage students to learn through interaction and co-operation, which involves the use of discussion, practical activities and hands on materials. (Author)

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STRENGTH IN NUMBERS

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A resource book for teaching adult numeracy

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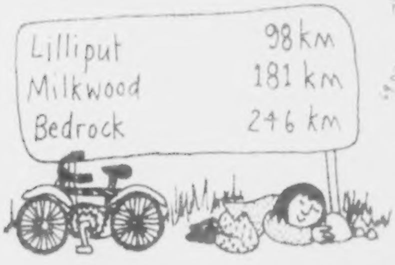
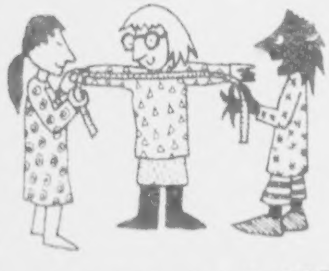
Beth Marr
Judith Martin





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STRENGTH IN NUMBERS
A resource book for teaching adult numeracy

Ruth Goddard
Beth Marr
Judith Martin

Funded by the Eastern Metropolitan Council of Further Education, Victoria, through Holmesglen College of TAFE.

Division of Further Education, Ministry of Education and Training, Victoria

STRENGTH IN NUMBERS: A resource book for teaching adult numeracy

Writers: Ruth Goddard
Beth Marr
Judith Martin

Project management: Holmesglen College of TAFE, Victoria

Project coordination: Beth Marr

Desktop Publishing by: Waverley Desktop Publishing

Illustrations: Judy Horacek

Diagrams & illustrations: Anne Donald
Barry Hodgson, Holmesglen College of TAFE

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Ruth Goddard, Beth Marr and Judith Martin

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ABOUT THIS BOOK

BACKGROUND

The past few years have seen a growing recognition that mathematical concepts and skills play a significant role in everyday communications and information. This has meant that in the area of adult literacy and basic education there has been a developing awareness that more teaching of maths and numeracy needs to occur. TAFE Colleges, neighbourhood houses and community centres have an increasing number of adult students attending maths classes. Literacy and language teachers have also seen the need to incorporate more everyday maths content into their teaching.

The students attending these classes often:

- lack confidence with numbers and basic maths concepts. Some have missed out on school, or had interrupted schooling, and have difficulty not only with mathematics, but also with reading and writing;
- need everyday mathematical skills, especially related to money, such as calculating change;
- feel that 'modern' maths is different and they are inadequate to help their children with maths. Topics like metrics and the use of calculators are seen as new and foreign. They have little ability or confidence to recognise that they do in fact have a considerable amount of mathematical knowledge.

Adult basic education teachers soon realised that traditional materials and methods of teaching maths were inappropriate for adult students. Although many basic maths books for children or, for example, the young aspiring technician were available, they were neither relevant in content nor approach to the lives, needs and interests of adults, particularly women.

In 1986 a group of experienced teachers working with adult students, experimenting with new materials and innovative methods, came together and formed the Teaching Mathematics to Women Project. This enabled the exchange of ideas and resources, and led to the writing, trialing and refining of materials. The result of that initial project was the book ***Mathematics: A New Beginning***.

However, that book did not deal with the lower level maths skills appropriate to adult basic maths students, especially those whose reading levels were low. This new book, ***Strength in Numbers: A resource book for teaching adult numeracy*** aims to fill that gap. Since ***Mathematics: A New Beginning*** has been very successful we have used the same format and layout. ***Strength in Numbers*** is suitable for students not yet ready for the level of ***Mathematics: A New Beginning***. The two can be seen as companion books.

WHO'S IT FOR?

Strength in Numbers was developed in response to the needs of numeracy or literacy tutors and teachers who teach basic mathematics to adults. Some of these tutors may be trained teachers, but others will not be formally qualified or confident in their ability to teach and, for example, may be unsure of what topics to teach or the ways to approach teaching them. There was also the need to write basic mathematics materials that reflected the needs and interests of adult students.

Strength in Numbers:

- assumes very little knowledge of formal mathematics by teachers, tutors and students;
- provides background, strategies and rationale for people inexperienced in teaching adult numeracy as well as new ideas for the experienced teacher;
- contains worksheets and activities especially designed for adults;
- uses language suitable for students with low levels of literacy skills; and
- has been produced by a team of teachers experienced in teaching numeracy and literacy.

The book, and the approaches taken, are primarily aimed at teaching groups of students, although many of the materials, strategies and ideas can be adapted for tutors working on a one-to-one basis with a student. Much of what we recommend depends on students discussing, sharing, talking and working co-operatively together - all of which is more likely to happen in a group. We would therefore encourage one-to-one tutors to try to establish a group with other tutors so that students can at least spend some of their time working together in a group situation.

WHAT'S IN IT

For ease of use the book is divided into six **Sections**, which are listed in more detail below. Most sections contain **introductions** which discuss in detail the topics covered and our approach to teaching them.

GETTING STARTED contains a selection of activities to generate a supportive classroom atmosphere and build students' confidence in their abilities to learn mathematics. Many of these activities involve language related problem solving and discussions, and could easily be incorporated in a literacy class. They would be suitable for use as an introduction to mathematics for students who would not otherwise have the confidence to tackle any maths.

EXPLORING NUMBERS contains a variety of activities designed to make students more comfortable with numbers and to develop understanding of the basis of our number system.

ADDITION AND SUBTRACTION includes hands-on methods for teaching the processes of addition and subtraction, practice examples and written problems which put these operations into meaningful contexts, group activities and suggestions and explanations of 'short-cut' methods.

In **MULTIPLICATION AND DIVISION**, as with addition and subtraction, the formal methods are developed from hands-on materials. Practice examples and word problems putting multiplication into context are provided. In addition there are sessions dealing with mental arithmetic strategies and 'short-cut' methods.

MONEY AND METRICS approaches the issue of decimals from the point of view of the real life contexts of money and the metric system. A range of practical activities which reinforce the concepts behind measurement are given, as well as everyday applications of money and metrics.

FRACTIONS AND PERCENTAGES deals with fractions and percentages at a functional level as they occur in everyday life. The sessions concentrate on a hands-on approach and the application of fraction skills to problem solving situations.

HOW TO USE IT

This book is a collection of material for teaching basic and essential mathematical concepts. Rather than using it as a traditional textbook to be followed from the beginning to end, select material according to the needs and interests of your students. Provided that you are aware of the skills and interests of your students and keep a check on the **Pre-skills** information, it is possible to use material from a number of sections at the same time. However, it will be apparent that within, and across, some sections there is a sequence or development of level of difficulty which should be followed to satisfy the learning requirements of particular students.

The book is in loose-leaf format so that:

- you can easily remove worksheets for photocopying;
- there is space for adding your own materials, notes and worksheets; and
- as future sessions and updates become available they can easily be incorporated.

The material is organised into **Session Outlines**, which are written in sufficient detail to be used just as they are, providing a structured class which works well with groups of adult students. However if you have the time, energy and creativity to adapt the material to your particular students then please go ahead, as this will further enhance its relevance and impact. Each **Session Outline** includes worksheets which can be photocopied and some contain hands-on materials for practical classroom activities.

Session Outlines are not intended to cover the time allocated to one class, as obviously this may vary. Each session covers a particular aspect of a topic which may take between half an hour to three hours or more to complete. Thus, several sessions may be conducted within one class, or alternatively, some sessions may take more than one class to complete. This allows you to teach two or more topics concurrently, providing variety for your students and allowing you to integrate related concepts, skills or topics. This is particularly relevant where mathematics is being integrated into literacy tuition, allowing for the maths content to be fully integrated into other contexts and skill areas.

The sessions are not intended to be taught in exactly the order in which they appear in the book. Sessions can be selected as appropriate for the work being undertaken or to match the interests and abilities of the students. However, when selecting a session check the **Pre-Skills** information to ensure that your students have the necessary skills, or have completed any recommended prior sessions.

The **Skills Developed** information tells you at a glance the mathematical, reading, writing, oral and general knowledge skills students will be using and developing in the session. The **Materials** information provides a checklist of worksheets, materials and equipment that you will need for the session.

A WORD ABOUT OUR MATERIALS AND METHODS

We have developed what we believe are important criteria and principles for the successful teaching - and learning - of adult mathematics and have attempted as much as possible to put these into practice in designing the **Session Outlines**. We believe that these criteria apply to the teaching of mathematics to anyone - young, old, male, female, from English or non-English speaking background - but are especially relevant to the teaching of adult basic mathematics or numeracy.

Our materials and methods attempt to:

- Ensure that all students in the group perform tasks at which they can experience **success**. This will build their confidence as they progress through your course.

- Use **language** as part of the mathematics teaching to explain ideas, concepts and terminology that can be understood by students and applied by them in talking, reading, writing and listening. Mathematical language should be kept relevant to the students and put into meaningful contexts. We have attempted to use everyday and common language, especially in the student worksheets, so that the work is accessible to, and understood by, a large range of adult literacy and numeracy students.

- Encourage students to learn through **interaction** and **co-operation**, which involve discussion, asking questions, explaining their reasoning to others, and working co-operatively in pairs or small groups.

- Use **practical activities** and **hands-on materials**. Throughout this publication we have advocated modelling operations using hands-on and practical activities to develop understanding and learn skills and rules. This seems the best way to distance students from the realms of the 'mystifying magic tricks' that maths teachers displayed to them when they were at school. Teachers who try the hands-on approach with adults, along with the other strategies recommended here, have consistently been rewarded with cries of "I see", "Now it makes sense" or "Why didn't they do it this way at school?" So the effort of cutting out fraction circles, cutting up straws or using counters is worthwhile and important. Another advantage of hands-on materials is that students can return to them confidently if they forget the process or the rule, or if they wish to check their reasoning.

- Teach concepts in a **context** relevant to adult students, drawing from their backgrounds, interests and experiences. This includes placing mathematical ideas into an historical and social context, in particular using the student's personal and work situation. It could take into account such maths related activities as shopping and banking, measurements, cooking, the weather, reading timetables and street directories, following directions, driving and travel, and sports activities.

- Enable students to learn about **other content or topics** while doing mathematics. This involves learning about other areas of knowledge whilst studying the mathematical concepts and skills embedded in them: areas such as diet, the environment, the geography of Australia, and public and world events. The advantages of expanding the topics and content areas is not only to give students a wider general education, but also supports the integration of a number of different areas of knowledge across the curriculum.

- Raise **awareness** about social and economic structures influencing our lives. This can be done by developing or analysing examples which refer to data and information currently available in the press, government reports and from other media sources.

- Make learning an **enjoyable** experience. Many adult students come to basic education with memories of traditional maths classrooms and dull maths lessons. It is our job to overcome this by providing an exciting classroom atmosphere with a range of activities and teaching approaches which stimulate interest and discussion. Most of all learning should be fun. Some of the activities, including some games, illustrate concepts whilst providing an opportunity for students to interact in a relaxed and enjoyable way.

▸ GETTING STARTED ◂

GETTING STARTED
Introductory Notes

The sessions in this section are designed to be used at the beginning of your course. For many students this is their first contact with the classroom for many years. They may feel "out of touch" with learning, and think that they have forgotten everything they once knew. It is important that classes at this stage are relaxed and friendly, and that mathematical concepts are introduced gradually, in a non-threatening way.

THE ACTIVITIES

In many of the activities in this section, students work in pairs or small groups, as we have found this the most effective way to build trust and group cohesion. We have also found that students who are relaxed and comfortable with each other and their teacher will have the confidence to contribute their ideas to group discussion or problem-solving and ask the questions necessary for successfully learning mathematics.

The activities are also practical, using hands-on materials rather than traditional paper and pencil methods. Use some of the activities in this introduction at the beginning of your course, then dip into it from time to time and select one activity to provide a variation from other work.

The activities are designed so that students:

- **Build Confidence**
  They are enjoyable, non-threatening and ensure success, so that students become relaxed about being in a numeracy class, more comfortable with numbers, and confident about their ability to learn.

- **Work Together**
  Learning involves exchanging ideas and information, and mathematics is no exception. All the activities are designed to be done in groups, so that students co-operate with each other, share their ideas, learn from each other, and become more comfortable with using the language of maths such as "sum", "difference".

- **Develop Mathematical Skills and Concepts**
  The introductory activities cover a range of important skills and concepts, including basic concepts such as greater, less, odd, even, problem solving, spatial concepts (eg. directions), metrics and calculators.

  They are also designed to raise student's awareness of the importance and relevance of maths to their daily lives.

Notes For One-to-One Tutors

Although these activities have been designed for use with a group, they can be readily adapted for your student. Work as a pair with your student or, if other members of the family are interested and available, invite them to join in. It could also be profitable to arrange meetings with other student-tutor pairs on a regular basis.

GETTING STARTED WITH YOUR GROUP

We have included examples of the early stages of two particular courses, to give you an idea of how to use this section to "get started".

Example 1: A basic numeracy class at a TAFE College.
The students were men and women in the 18 to 40 years age range, some of whom had been referred from a program for the Mildly Intellectually Disabled and others who had enrolled through normal college channels. The class thus had a wide-ranging level of skill.

Session 1 (2 hours)

As students arrived, they introduced themselves and talked about why they came to the course, what their expectations were, and what they wanted to learn. A great deal of anxiety was expressed by one student.

- Played the Name Game to help students learn each others' names.
- Activity from: *Numbers in Our Lives*
  This generated a lot of discussion about basic number concepts in the context of students' lives.
- Activity from: *How Does Maths Figure in Your Life?*
  Some discussion of activities; exercise set for homework.
- Discussion with individual students on areas of work in which they wished to develop their skills.

Session 2 (2 hours)

Individual worksheets were selected, as enormous skill differences were already evident in the group.

- Further discussion about attitudes to maths, including the activity *Maths and Me.* This allowed students to be more specific about their goals.
- Co-operative Problem solving (*What is the Mystery Number* and *What is the Secret Number*)
- Some measurement activities from *What Is Your Measure?*
- Students worked individually and in pairs on prepared worksheets.

Example 2: A numeracy class at a neighbourhood house.
There were 4 students - 2 with a migrant background, 1 male. It was a 2 hour class in the afternoon. These are some of the activities and discussions that took place in the first session:

- General introductions between students and tutor - names; why they are coming to the class; their past experience with maths. Three of the students were also attending a literacy class at the neighbourhood house.

- Read through *Maths and Me* worksheet as discussion was more helpful than trying to write out the answers.

- The tutor explained the type of work which could be done in class, probably starting with the calculator, money and metrics. Books were shown to students.

- Explanation of the use of calculators by the tutor who had brought along 4 calculators.

- Played a game on the calculator - *Target Score*. The game was played until everyone was feeling confident with using the calculator. Explained how to deal with errors on the calculator.

- A discussion followed about whether students should be using calculators, as students felt that using them was cheating.

- The tutor showed the students how to use the constant function on the calculator to form the multiplication tables, and how to use the memory. Played the game, *Guess My Number*.

- To check the students' abilities with money the game, *Make a Dollar*, was played using the student's money.

- It was agreed that the next class would start with metric measurement. the tutor would bring in a range of books and resources and the students could decide upon their individual areas of work.

NAME GAMES

Skills developed
- Remembering names

Materials
- Tennis ball for the second game

These 2 games give the group a chance to learn each others names. They are ideal for use in a first session, but may also be used in later classes as reinforcement.

SESSION OUTLINE

Name Game 1

A short memory name game to break the ice and introduce staff and students to each other.

Participants sit in a circle with their name tags removed. Starting anywhere in the circle, someone says their first name e.g. Patsy. The person on their left repeats the name and adds their own - Patsy, Lim. This continues around the circle with each participant adding their name to the list. When the list is complete, go around the circle again to give everyone a turn at reciting all the names. (Prompting from others should be encouraged if someone gets stuck).
An interesting extension is for everyone to change places and try to recite the names again in the new order and see how well people's names have been matched to their faces.

Name Game 2

This is a good game to play after the names have been learnt in order as in **Name Game 1.**
The group stand in a circle. One member has a tennis ball, calls out another person's name while throwing it to them. They in turn throw it to another person, calling out their name, and so on, until every person has received the ball at least once. The teacher/tutor should make sure that no one is forgotten.

OVERCOMING MATHS ANXIETY

Around 1976 the term "maths anxiety" was coined. It was used to describe the "panic, helplessness and mental disorganisation that arises among some people when they are required to solve a mathematical problem." (Tobias 1978)

WHAT CAUSES MATHS ANXIETY?

Familiar to the teacher of adult students are the following comments: " I haven't got a mathematical mind", or "I'll never be able to understand fractions." When such comments are explored, graphic descriptions of the experiences which shaped these attitudes often emerge.

Students tell of years spent in classes understanding little of what was said by a teacher who ignored them in favour of high achieving students. Many suffered humiliating experiences at the hands of unsympathetic teachers. A commonly cited example is that of students who, when unable to solve a problem, were expected to attempt it on the blackboard in front of everyone else.

There are many such stories, each of them contributing to a volume of negative classroom experiences which created fear, feelings of inadequacy, loss of confidence and consequently avoidance of mathematics.

Students whose classroom experiences may not have been so negative still had many barriers to overcome. Mathematics was taught to them in a competitive classroom atmosphere by an often remote and impatient teacher who applied magical rules to sums which had very little to do with their own lives and experiences. Traditional classroom organisation - rows of students sitting quietly at desks - denied students the valuable opportunities of discussing and working out problems together, reinforcing many students' feelings of isolation and fear. Emphasis was placed on applying the right rule to get the right answer rather than exploring and understanding the principles involved.

When explanation was attempted, teachers relied primarily on abstract and verbal reasoning, making little or no use of hands-on materials or visual aids, which would have assisted them to a thorough understanding of the concepts and processes they were attempting to master.

Timed tests, "quick quiz" mental arithmetic, and the pressure to get through a set syllabus meant there was always a need for speed. Students who could not catch on quickly tended to be ignored or punished. Experiences like this created anxiety and thus blocks which recur later to frustrate further learning.

HOW CAN WE OVERCOME MATHS ANXIETY?

It is often very helpful for maths anxious students to share their experiences. Discovering that they are not alone, and understanding how these experiences contributed to their fear of maths gives them a new feeling of confidence and determination to overcome their blocks.

Being in a classroom learning maths often brings those fears to the surface again. However, as adult learners, students now have many more resources than they had as a child and quickly develop simple and effective strategies for dealing with their fears. A group brainstorming session is ideal for generating ideas and strategies for overcoming maths anxiety.

The session *Maths and Me* is particularly useful at the beginning of a course. Students share their experiences of learning maths in the past and identify problem areas or experiences that they may share. It can be used to set goals and agree on a starting point for your course.

The session *How Does Maths Figure in Your Life?* is also useful as a later session for discussion of student goals. It helps to pinpoint which are the skills they will need and thus the group members can contribute to decisions about the design of your course.

MATHS AND ME

Skills Developed

- Awareness of feelings about maths.
- Understanding of the causes of maths anxiety
- Establishing learning goals.

Materials

- Worksheet

Many students experience considerable anxiety about returning to study mathematics. This session, which is best conducted at the beginning of a course, provides students with an opportunity to:

- share their feelings and attitudes about maths with each other
- compare their experiences of learning maths in the past
- understand how and why many people experience maths anxiety
- pinpoint areas of difficulty and/or gaps in their maths skills
- establish learning goals.

PREPARATION

Read *Overcoming Maths Anxiety* which summarises the syndrome of maths anxiety.
Depending on the literacy/language level of the students you may decide to present this to your group as a purely verbal exercise or to use the sentence starters as they are presented in the Worksheet.

SESSION OUTLINE

- Explain to students that our feelings and attitudes about maths have a great impact on how successful we are, and that the purpose of the session is to explore these feelings and attitudes. We will look back to our school days and remember what it was like then to learn maths, as well as how we feel now.

- Explain also that a second purpose of the session is to identify some of the maths skills we want to develop.

- If you are using the written worksheet distribute it and allow students 5-10 minutes to fill it out as much as possible (rough notes will do).

- After completing the worksheets bring these together, discuss their responses, and elaborate on some of the main issues raised.

- If you are conducting this activity as a verbal exercise read out the sentence starter and ask each of the students to respond in turn. Discussion should follow after each set of responses.

MATHS AND ME

Worksheet

Please complete these sentences:

Maths makes me feel...

....

Maths at school was...

....

I've never been able to...

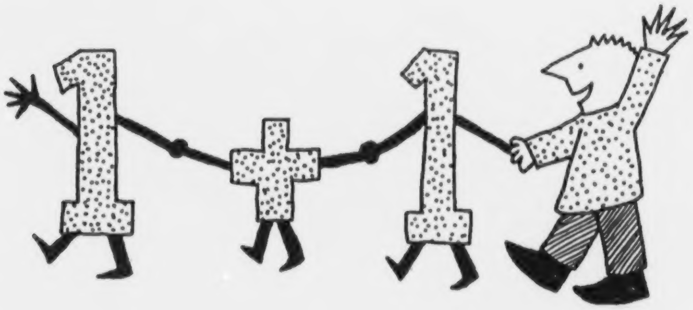
....

I'm good at...

....

I'd like to learn how to..

....



NUMBERS IN OUR LIVES

Skills developed

- Interaction within the group
- Practice with numerical language

This session is designed to enable students

- to get to know each other
- talk about everyday numbers in a non-threatening and interesting way - people are curious about each other.

This is also a good activity for you to observe students confidence with numbers.

SESSION OUTLINE

There are 2 activities to choose from or you may want to use both.

Activity 1 About Me

Go around the group and ask each member in turn to make a simple statement about themselves involving numbers. You should start the ball rolling with the first statement.

Some ideas are:

- *My uncle has only 8 toes*
- *I am 158cm tall*
- *My favourite number is 7*
- *I have 3 children*

There is fun to be had here when students warm to the idea and they may want to make more than one statement.

For 1-1 Tutors

You and your student each think of 10 facts about yourselves. Take it in turns to give a fact.

Activity 2 Questions About Others

Now you or the students can gather information about the rest of the group by asking questions.

Begin by making a few suggestions yourself, as some people will find it difficult to think of a question immediately. Discussion will stimulate ideas. The questions can be recorded on the board or butcher's paper, one question from each student.

eg.
- *How many times a year do you go to see a film?*
- *How many people live in your house?*
- *How many cups of tea or coffee do you have each day?*
- *How many years since you were at school?*
- *How many children do you have?*
- *What size family did you come from?*

Now that you have the questions you will want to collect the answers. This could be done in several ways:

1. You collect answers and record them on the board, discussing the results as they are collected.

2. Students could move around the room collecting answers to their own question, giving them experience in collating data.

   eg.

Name	Number of Films
Gary	10
Soula	6

   They would then come together and discuss their results.

3. Within the group the students ask their question and others answer verbally with discussion following each question.

Further Ideas

1. Questions such as the first one above can lead into a discussion about estimation.

2. Some questions can be used to introduce graphs and tables if it seems appropriate at this stage. Ask the students to imagine how their information could be represented pictorially.

   eg. In a class of 10 students, the responses to the question:

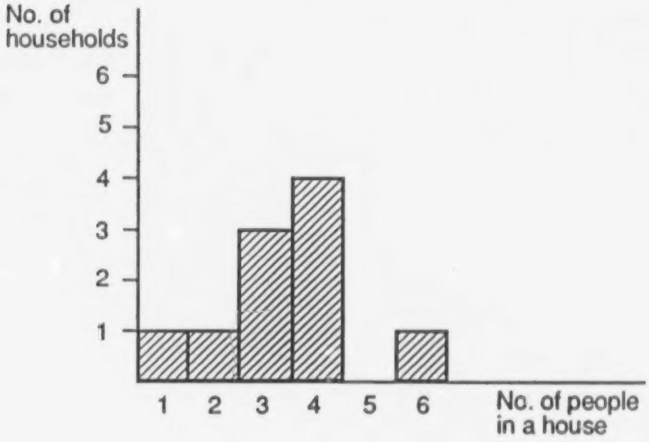
   How may people live in your house?

   could be recorded as:

- a table

Number of people in a house	Number of households
1	1
2	1
3	3
4	4
5	0
6	1

- a graph



CO-OPERATIVE LOGIC

Skills Developed
- Group co-operation
- Logical reasoning
- Using hand-on materials
- Guessing solutions
- Checking
- Organising information

Materials
- Copies of logic problems

This session introduces students to two important aspects of mathematical thinking and learning: working co-operatively, and developing and applying problem solving strategies.

Each student has clues important to the solution of each problem. By combining these clues the group can reach a unique solution.

Some of these problems use numbers and related concepts, others are spatial. You may wish to do 1 or 2 of these in any one class.

PREPARATION

Copies of the problems are attached to this session.
Make one copy of each problem for each group of students (4 is an ideal group size). Glue each sheet onto card and cut out the clue cards and moveable pieces. Store each problem in an envelope, and label it.

SESSION OUTLINE

Introducing the activity

- Explain to students that the purpose of the class is to help them improve their logical thinking and develop their problem solving skills, by solving logic problems.

- Each problem is to be solved co-operatively, and students need to work together to find an answer.

- Emphasise that each person will have different clues, so it is important to listen as each clue is read. We have tried to keep reading levels simple. However if any student finds it hard to read, another group member or the teacher/tutor could help.

Procedures:

- Place question card on centre of table.

- Share out clue cards among the students. Some may receive more than one depending on the size of the group.

- Instruct students to read their clues aloud, in turn.

- As each clue is read, encourage students to manipulate the moveable pieces to represent that information and modify the solution so far.

- When a solution is reached, students should read through all the clues again to look for contradictions and thereby check their solution.

Note

Although answers have been included it should not be necessary to check them or to ask the teacher for correction. The group should be satisfied for themselves that they have met all the conditions. This is the beginning of the notion of self checking which should constantly be reinforced by you as a teacher/tutor, eg. checking subtraction by addition.

Points to Keep in Mind

We have included moveable pieces in all of these problems in order to:

- Discourage students from using pencil and paper. When students start to work out solutions by writing, one person usually dominates and co-operative problem solving is replaced by individual problem solving.

- Encourage students to explain to each other words that are not understood eg. odd, opposite, West. You should intervene only when no-one in the group knows the meaning.

As the game progresses you can observe which students understand all the terms used without help. This is a good opportunity for you to observe, without testing, any basic concepts missing in the students' backgrounds.

Discuss Strategies

Discuss the strategies used to solve the problems. Apart from working co-operatively, the two most important problem solving strategies underpinning these exercises are:

(1) Guess and check - take risks and try out solutions to see if they work.

(2) Using a visual aid, such as hands-on materials. These give us a **picture** of what we are doing.

These two strategies form the basis of much problem solving in mathematics.

Further problem solving strategies will be explored in subsequent sessions.

Discuss Group Dynamics

You *may* wish to draw attention to the behaviour of your students within the group and discuss how they actually operate in a co-operative situation. There are several ways to approach this:

1. When students have completed one or two problems ask them to describe what happened in the group while they solved the problem.

   Ask questions like:
   - *Did anyone talk more than the others?*
   - *Was anyone very quiet?*
   - *Did all of you have a say?*
   - *Did someone take a role ,as say a leader?*

2. Have a more theoretical discussion about general roles which emerge in group situations eg. leaders, followers, talkers. The discussion could draw on roles taken within their homes, other classes, workplaces, etc.

3. Finally ask students to reflect on their own way of operating in groups and to decide whether they would like to change it in any way.

What is the mystery number?

<table>
<tr><td colspan="2">What is the mystery number?
(Place in the centre of the table)</td></tr>
<tr><td>The number is even and less than 30</td><td>8 is not one of its digits</td></tr>
<tr><td>The number is neither 20 nor 24</td><td>The sum of its digits is even</td></tr>
<tr><td>One of its digits is 2 (but the number is not 22)</td><td>The number is more than 10</td></tr>
<tr><td>The number is not 22</td><td>The number is less than 30</td></tr>
</table>

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What is the secret number?

<table>
<tr><td colspan="2">**What is the secret number?**
(Place in the centre of the table)</td></tr>
<tr><td>The sum of the digits is even</td><td>The number is less than 20</td></tr>
<tr><td>The number is greater than 10</td><td>Zero is not one of the digits</td></tr>
<tr><td>The difference between the two digits is 6</td><td>The number is odd</td></tr>
</table>

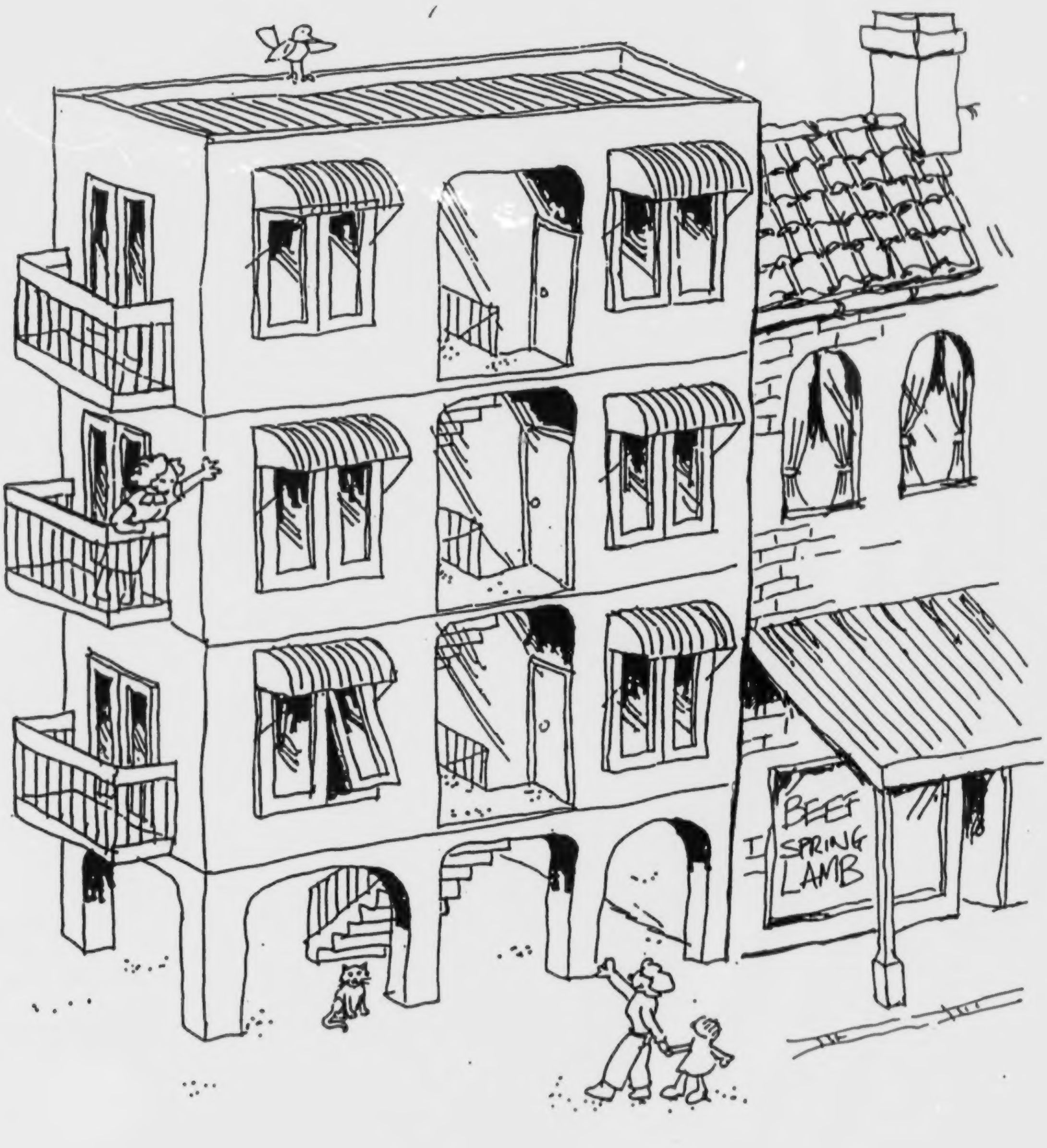
DIGIT SHEET

Photocopy these (onto card or paper), cut them up and put a set with each of *Mystery Number, Secret Number* and *How Old is Everyone in the Burns Family?*

1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9
0	0	0	0	0	0	0	0

THE FLATS

(Place this in the centre of the table)


BEEF
SPRING
LAMB

Problem: Who lives in which flat?

THE FLATS

SARTORI

FISHER

JOHANNSEN

BATES

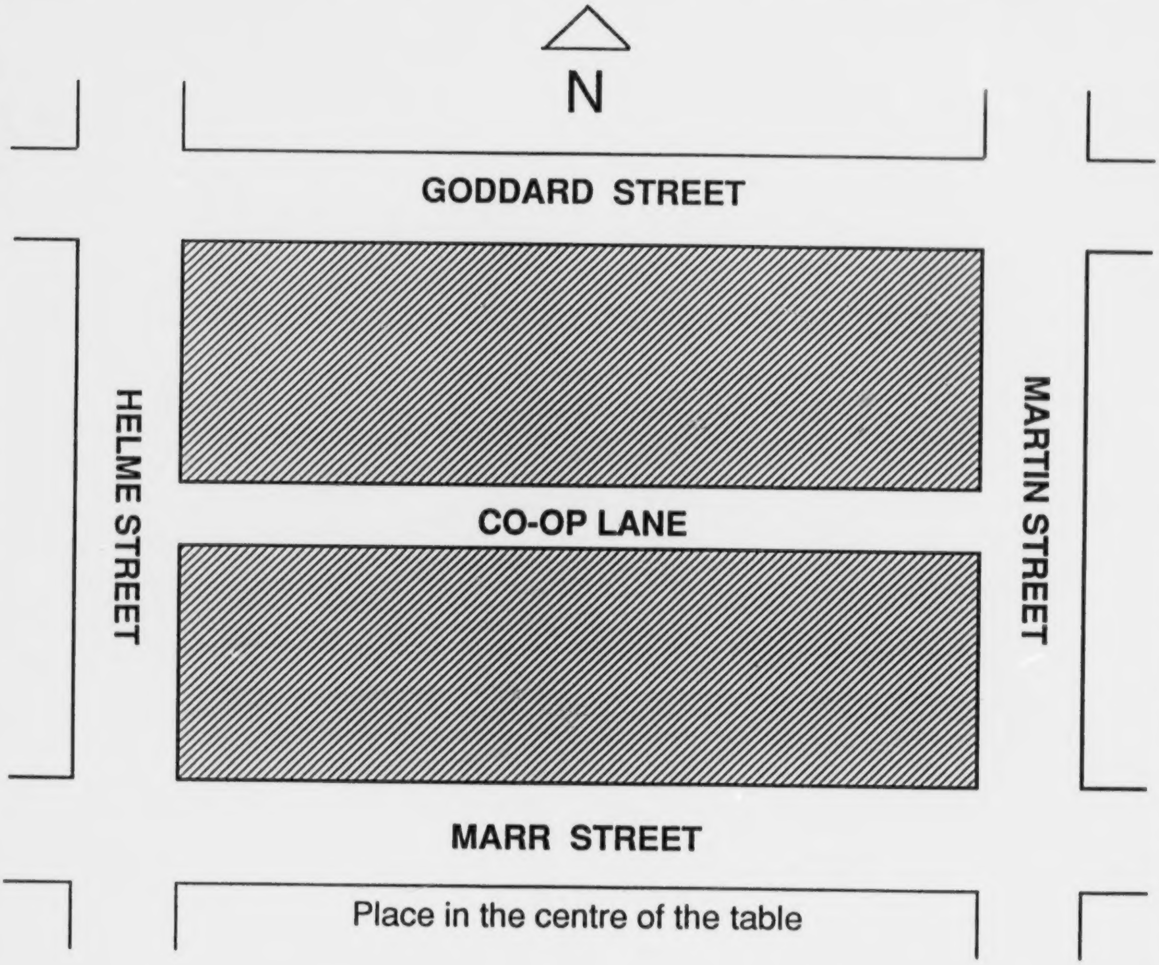
TRAN

WOODS

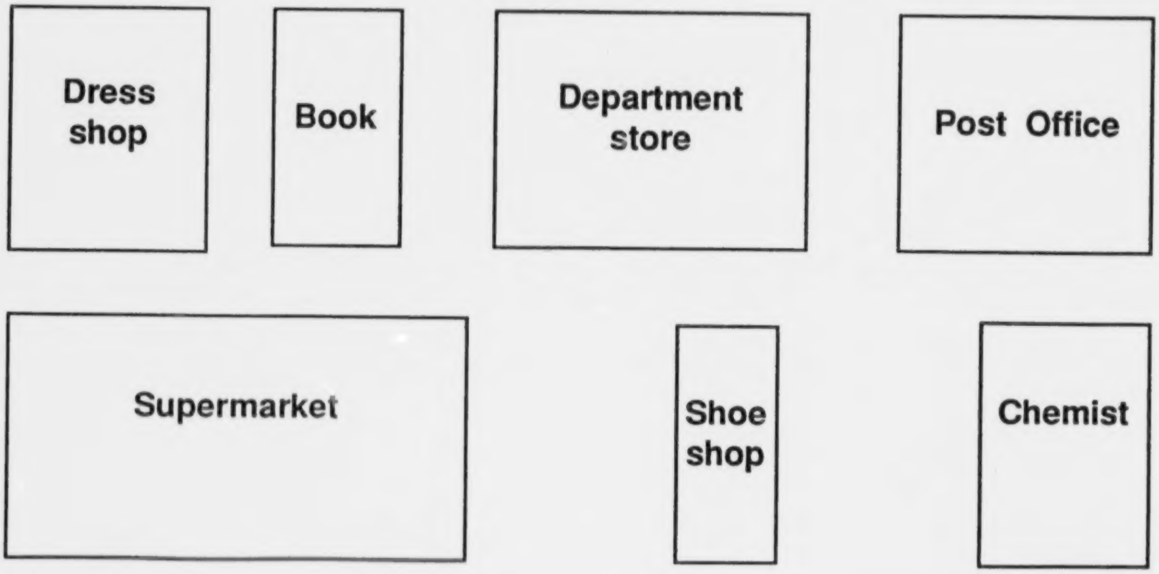
Jo Fisher walks downstairs to feed Maria Sartori's cat when she is away.	The Woods knock on the Tran's floor when their music is too loud.
The Johannsen family hear Mr Wood's feet overhead when he dances.	The Fishers do not live opposite the Johannsen family.
Maria Sartori passes the Bates' flat on the way up to visit the Tran family.	The Fishers grow tomatoes on their balcony in summer.

CITY BLOCK

PROBLEM : Arrange the shops in the shaded city block


N
GODDARD STREET
HELME STREET
CO-OP LANE
MARTIN STREET
MARR STREET

Place in the centre of the table

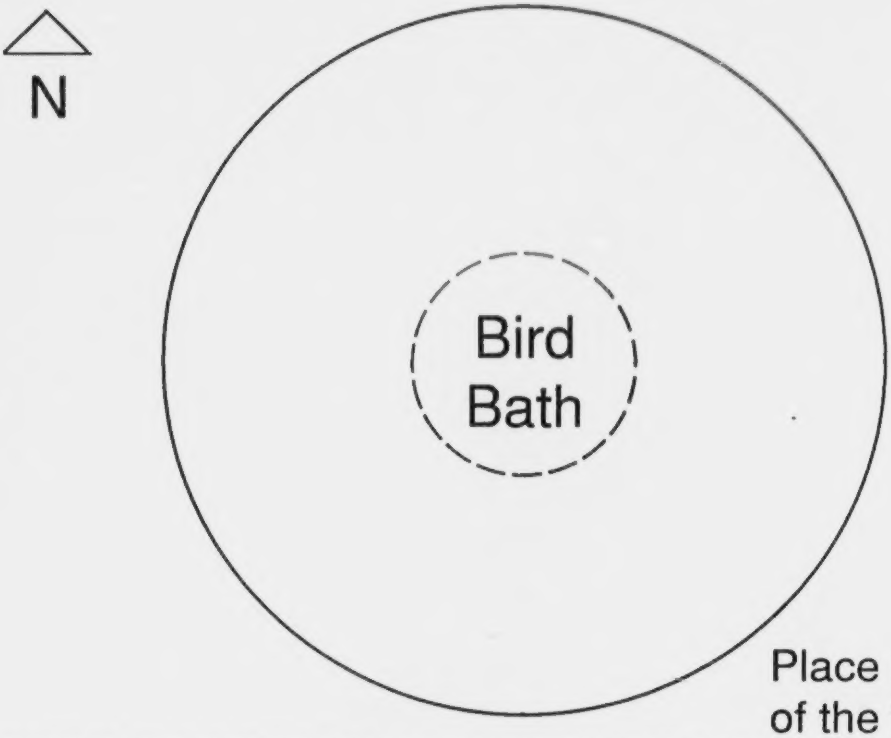

Dress shop
Book
Department store
Post Office
Supermarket
Shoe shop
Chemist

CLUES - CITY BLOCK

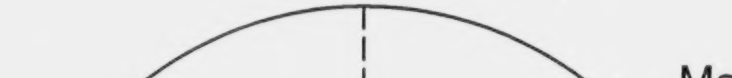
Walking from the supermarket to the chemist, you pass the dress shop.	The post office is south of the chemist, and next to the shoe shop.
The department store and the post office are on corners.	The post office is opposite the dress shop.
The chemist shop is east of the supermarket.	The supermarket is north of the bookshop.

HERB GARDEN

Problem: Arrange the herbs in Judith's garden.



Place in the centre of the table


Basil
Sage
Rosemary
Parsley
Oregano
Dill
Mint
Garlic

Moveable pieces

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CLUES - HERB GARDEN

The oregano is opposite the garlic.	The sage is between the mint and the basil.
The rosemary is at the south end of the garden.	The bird bath is in the centre.
The parsley is opposite the mint.	The dill is next to the garlic.

Which car will they buy?

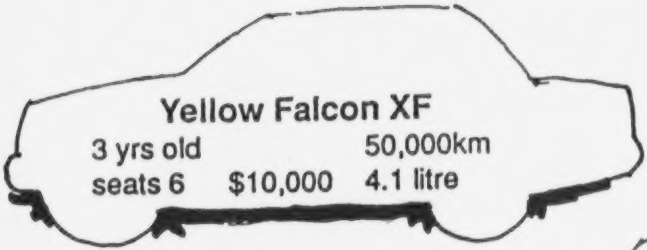
The Rizzo family want to buy a used car and all the family members have a particular request.
The family is :

Mr. Rizzo
Mrs. Rizzo
Tina Rizzo (aged 19)
Jo Rizzo (aged 17)
Tom Rizzo (aged 14)
Grandma

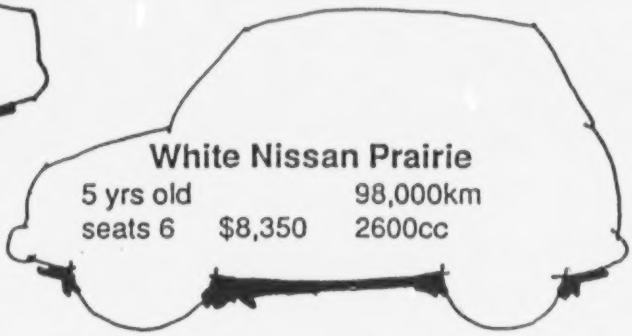
(Place this in the centre of the table)

"You can't spend more than $10,000", says Mrs Rizzo.	"We all go out together sometimes", says Tom.
"I don't want to learn to drive in a car more than 5 years old" says Jo.	"A car which has done more than 100,000 km needs too many repairs" says Mr Rizzo.
"I do not want to drive a high powered car. Something less than 3 litres" says Tina.	Grandma had heard that blue or grey cars are not easy to see.

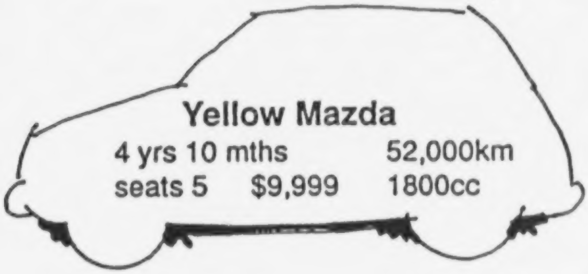
Which car will they buy?



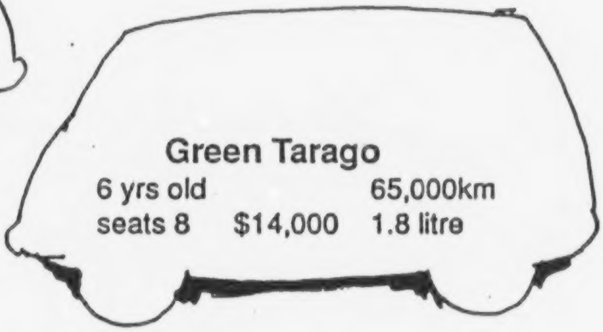
Yellow Falcon XF
3 yrs old 50,000km
seats 6 $10,000 4.1 litre



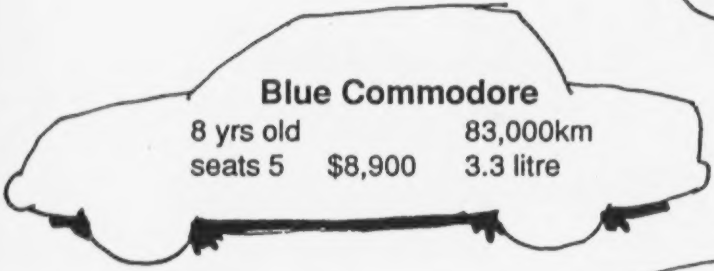
White Nissan Prairie
5 yrs old 98,000km
seats 6 $8,350 2600cc



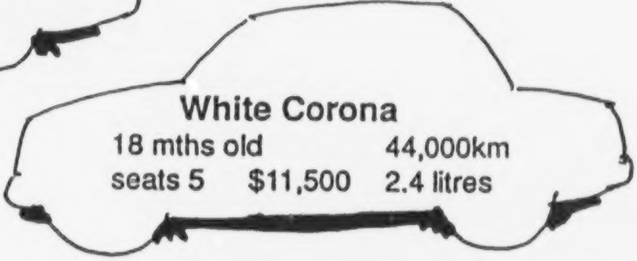
Yellow Mazda
4 yrs 10 mths 52,000km
seats 5 $9,999 1800cc



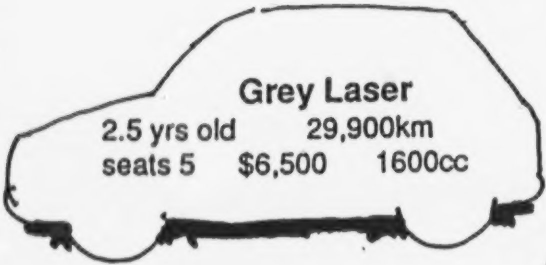
Green Tarago
6 yrs old 65,000km
seats 8 $14,000 1.8 litre



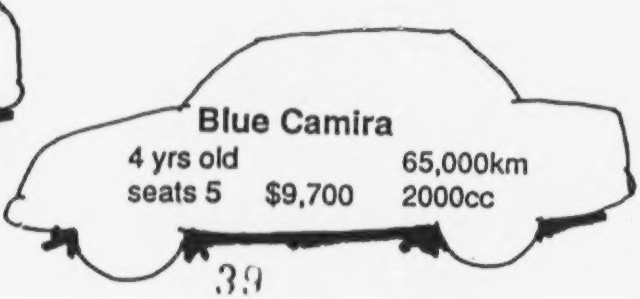
Blue Commodore
8 yrs old 83,000km
seats 5 $8,900 3.3 litre



White Corona
18 mths old 44,000km
seats 5 $11,500 2.4 litres



Grey Laser
2.5 yrs old 29,900km
seats 5 $6,500 1600cc



Blue Camira
4 yrs old 65,000km
seats 5 $9,700 2000cc

The Burns Family

NICHOLAS	**SANDRA**	**COLIN**
ALICE	**JOHN**	**ANDREW**

(Place this in the centre of the table)

Problem: **How old is everyone in the Burns family?**

Alice is three years older than Andrew.	Sandra was 27 when her son Andrew was born.
Colin, Sandra's partner, is four times older than Alice.	Yesterday they had a party for Andrew's sixth birthday.
Sandra's third child Nicholas is half Andrew's age.	John, Sandra's brother, is twice as old as her daughter Alice.

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HOW DOES MATHS FIGURE IN YOUR LIFE?

Skills Developed
- Identifying mathematical learning needs

Materials
- Worksheet

TEA
250g
FRUIT DRINK
2 litres
Instant Coffee
150g
Sliced Peaches
822g
Margarine
500g

This is an activity which encourages students to look at how much mathematics arises in their daily lives, and whether or not they have the skills to cope with it.

It also provides an opportunity for you to set learning goals in consultation with the students.

SESSION OUTLINE

Begin with a discussion about what mathematics students have used, or could have used, in the last day or two.

You may need some leading questions to initiate discussion, such as:

- *How did you decide what to buy?*
- *Has anyone had to get money from the bank this week? How did you decide what you needed?*
- *Did you go shopping - What did you buy? How did you make decisions?*
- *Has anyone been on a trip on public transport, used a street directory, had to decide what time to leave home?*

Draw the students out to talk about what they have done in the last few days and encourage them to see the maths/ numeracy related skills they might have used.

An example or two from your own day such as the following might help to get them talking and thinking.

TASK

a) Deciding whether to go to the bank before I go out tonight.

b) Making a pair of shorts.

MATHS SKILL

a) Estimation, addition, subtraction

b) Metric measurement, manipulating shapes, estimation, geometry (eg. parallel lines).

As you talk it may become apparent that a lot of the calculations involved in everyday tasks are things which numerate people "do in their heads" and usually in fact **estimate** rather than calculate exactly. This may or may not be the case with your students, depending upon their skill levels. It may in fact turn out that they have very different ways of coping with time and quantities of money, or even that these are skills they don't have and wish to acquire.

Ask them to take away the worksheet. *How Does Maths Figure in Your Life* and make rough notes to bring back next week. You can help fill in the skills column if this would prove too hard for them to do alone.

Alternatively, just ask them to think about the things they do during the week and fill in the sheets together next session.

Discussion of the results should focus on:

- Skills the students already have
- Skill they don't have but want to learn
- The importance estimating has in daily life calculations (this should be a skill you encourage students to learn).
- The value that numeracy skills will be to them.

From the discussion you should make a list of learning priorities for the group, or for each individual student. Numeracy classes are notorious for the range in students' abilities, so the individual goal sheets will probably be necessary.

HOW DOES MATHS FIGURE IN YOUR LIFE?

Worksheet

Make notes of the things you do which use numbers or other maths

TASKS	NUMBER OF MATHS SKILLS I USED	OTHER SKILLS THAT WOULD HAVE HELPED ME
eg Buying lunch		

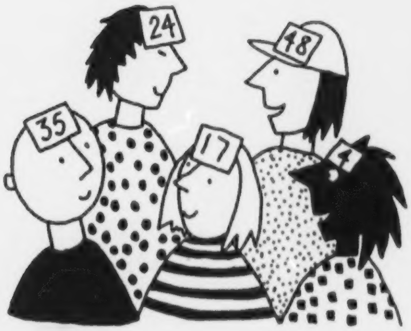
GUESSING GAMES

Skills Developed

- use of quantitative language eg. less than, even and odd, digit
- practice at remembering information
- developing strategies to solve problems

Materials

- sticky labels
  or
- small pieces of paper and sticky tape



Here are two activities which involve guessing a number by asking questions of group members. Choose one of these to do now and maybe do the other another time.

Either is suitable as an introductory activity with a new group to encourage them to talk to each other and to practice quantitative language. Neither requires writing and both allow students to develop some problem solving strategies.

SESSION OUTLINE

Guess My Number

1. Supply each student with a number stuck on their forehead or just below the neck, where they cannot see it, but other group members can.
   Make sure the numbers are not too high for your group to manage. eg. begin with 1-50 and go higher on successive rounds of the game.

   The aim of the activity is for each person to discover their own number by asking questions which can be answered only by 'yes' or 'no'.

2. To demonstrate possible strategies it is a good idea for you, the tutor/teacher, to go first with a number provided by a student. This way you can point out possible questions which will eliminate many numbers and focus into a small range:

   - *Is it an odd number?*
   - *Does it have 2 digits?*
   - *Are the digits the same?*
   - *Is the number more than 50?*

   Questions such as *'Is it 65?'* are not very helpful until the questioning has narrowed down to a few possibilities.

You can use this time to make sure that the students know:

- the meaning of odd and even (sufficient to say that even numbers end in 2,4,6,8,0)
- less than 50 does not include 50
- digit is one single figure in the number ie. one of the numbers from 0 to 9

Tell the students they can either follow your line of questioning or invent their own.

3. Now divide students into groups of 2 or 3 and one at a time they should discover their own number.

   If you want to introduce competition, the winner is the one who finds their number with the least guesses in each group.

What floor am I on?

This activity differs from the first in that:

- students are using the language of ordinal numbers ie. first, second, thirty first, etc.
- students are working co-operatively to develop strategies.

1. Break students into groups of 3.
2. One student (the hider) thinks of a floor number between 1 and 100, writes it on a piece of paper and conceals it. The other two students guess what floor he or she is on, asking questions to which the hider can answer only "yes" or "no".
3. The hider keeps a tally of the number of questions asked.
4. Change to the next 'hider' in the group, with the other two asking questions.

   The pair that gets the correct result with the smallest number of questions wins the round.

   Discuss strategies for solving the problem when students have played a few rounds.

WHAT IS YOUR MEASURE?

Skills Developed

- Calculator use
- Metric measurement
- Understanding basic Maths vocabulary

Materials

- Metric tapes with cms marked clearly
- Clock/watch with a second hand
- Calculators
  - 1 between 2 students

This session focuses on the students themselves by measuring various parts of their bodies and analysing the data. It provides practice in

- using a metric tape to measure to the nearest centimetre
- using the second hand on a watch as a timing device
- performing simple operations on calculator
- interpreting a variety of words which express relationships between quantities.

One of the important skills students should gain from your course is the correct use of a calculator.
This session provides a gentle introduction to the calculator by using +, -, = and clear buttons to arrive at answers to a series of questions about the measurements they have made.

Justifying the Use of Calculators

Many adults still feel that using a calculator for maths is "cheating", and so the use of calculators and the importance of calculators in maths may need to be justified. You may wish to consider the following points in your discussion.

- The Calculator is only a tool for arithmetic and can not do the mathematical thinking for you.
- People used to use slide rules and log tables and the Chinese still use the abacus. The calculator is just replacing traditional methods of calculating.
- Employers use calculators and expect their employees to be able to use them.
- Many research studies have been done and not one shows any damage to learning of arithmetic skills from using a calculator.

For more information about justifying the use of calculators in maths see the *Australian Association of Mathematics Teachers'* "Calculator Policy".

ACTIVITY 1 : Familiarisation with the metric tape

First have a quick discussion about what units are used for lengths in the metric system. Refering to clothing sizes might help if no one has any ideas.
Give out one tape between 2 or 3 students so that they work together. Ask students to measure a convenient object such as a piece of paper.
Discussion should arise about centimetre marks on the tape. Encourage measuring to the nearest centimetre. Although millimetres should be acknowledged they are too fine to use at this stage.

To familiarise students with the metre marks on the tape, ask them to measure a larger object such as the length of the table, the height of the door. Choose also some objects longer than the tape in hand. If necessary discuss how to handle this.

When you are happy that all students are at ease with using the tape, proceed to activity 2.

ACTIVITY 2 : About Us - Measurements

Select from the following list of measurements students can make (be sensitive about which of these you choose for your group). Lengths should be measured to the nearest centimetre.

- *How long is your stride?*
- *How tall are you?*
- *How wide is your armspan (with arms outstretched from fingertip to fingertip)?*
- *How long is your foot?*
- *What is your handspan? (with hand stretched)*
- *How far apart are your eyes?*
- *What is the circumference of your head?*
- *What is your waist measurement?*
- *What is your bust measurement?*
- *What is the height of your waist from the ground?*
- *What is the length of your head?*

To record the information construct a table on some butchers paper (can be kept for later use) and ask the students to fill in their own values.

	Height	Head Circumference	Foot length	Head length	Wrist to elbow
Soula					
Sam					
Jo					
Kim					

Using the information and your calculator

Here are some possible activities which will incorporate the use of mathematical language and the measurements you have collected. Encourage students to use **calculators** for the addition and subtractions so that they become familiar with the basic operation keys.

- *What is the difference in height between the tallest and the shortest person?*
- *How far would you stretch if you were all to lie head to foot on the floor in a line?*
- *What is 10 centimetres more than your height?*
- *What is the difference between your handspan and your foot length?*
- *How much longer is :*

  eg: Soula's foot than Sam's foot
- *How much shorter than :*

  ____________________ *is* ____________________
- *How much further does :*

  ________________ *stride than* ________________
- *If* ________________ *took 10 paces, how far would they go?*
- *If everyone stood with their arms outstretched how far would they stretch?*

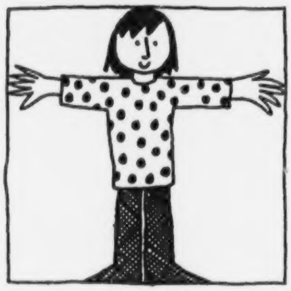
ACTIVITY 3 More Complicated Doings

Here are some further ideas for numerical work which can be done with the body measurements made in *ACTIVITY 2*. Work with all of your students in a group to do these activities and discuss them.

- Arrange the heights in order from shortest to tallest. (This can be checked by all standing in line afterwards) Decide who is the middle person - their height is then the **median** height in statistical jargon.

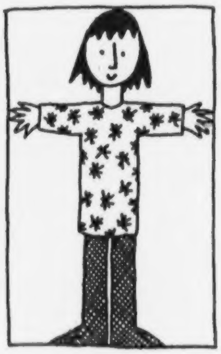
- How many head lengths are equal to your height (to the nearest whole number). This could be done by repeated addition if students do not yet have an understanding of the concept of division.

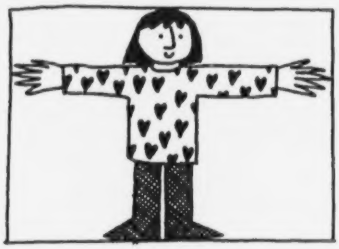
- Are you a square?
  (compare height
  and armspan)



OR

- Are you more of a rectangle?
  (draw your shape approximately and mark the measurements on your rough diagram).





ACTIVITY 4 Body Times

Normal Pulse Rate

Working in pairs

- time each other's pulse over 1 minute
- time each other's pulse over 15 seconds

Ask students to use a calculator to work out a **1 minute** pulse reading from the 15 second pulse reading. Compare the answer to the actual 1 minute reading. If the readings are close then 15 seconds could be used as the measuring time.

Changing the Pulse Rate

Pulse rates change quite quickly and markedly after exercise or after a few minutes lying down. Choose the most appropriate activity for your group from those below.

Lying Down

Still working in pairs

- 1 student should lie down for about 5 minutes to allow the pulse to settle
- the partner takes the pulse reading, over either 15 seconds or 1 minute, and records

standing pulse over 1 minute = _______
lying pulse over 1 minute = _______
difference = _______

(You can expect a difference of about 10 beats)

Exercising

- Ask students to exercise for about one minute. They could all run up and down the stairs, jump on the spot, walk briskly, or whatever.
- In pairs they should measure the pulses again, as above, but this time take readings directly after exercise and then 5 minutes after.
- Again record values and work out the difference between the pulse rate when standing and immediately after exercise.
- Discuss the readings 5 minutes after exercise. Have you returned to normal?

(Physically fit people should have regained a normal reading, but take care not to worry students by making sweeping statements about this.)

GETTING STARTED Answers

CO-OPERATIVE LOGIC

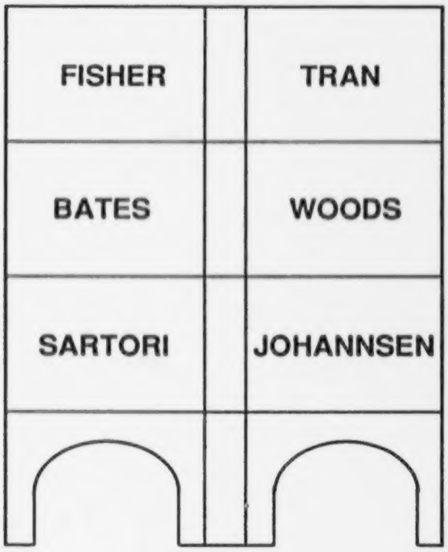
MYSTERY NUMBER

26

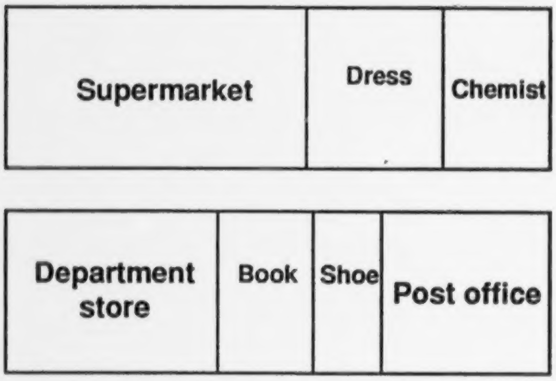
SECRET NUMBER

17

FLATS


FISHER
TRAN
BATES
WOODS
SARTORI
JOHANNSEN

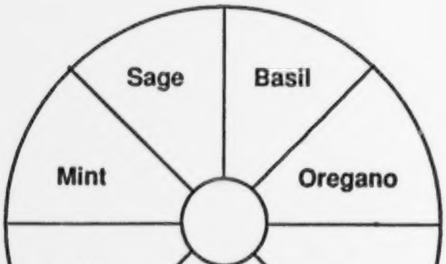
CITY BLOCK


Supermarket
Dress
Chemist
Department store
Book
Shoe
Post office

CARS

White Nissan Prairie

HERB GARDEN


Sage
Basil
Mint
Oregano
Garlic
Parsley
Dill
Rosemary

BURNS FAMILY

Sandra 33, Colin 36, Alice 9,
Andew 6, Nicholas 3, John 18

▸ EXPLORING NUMBERS ◂

EXPLORING NUMBERS
Introductory Notes

This section is designed to assist students to gain familiarity and confidence with many aspects of numbers: the language used to express them and some of their basic properties. It will be especially valuable for teachers integrating numeracy into a literacy program or teaching the language and conventions associated with numbers in our language to students learning English as a second language.

The session *Stories with cards*
Guess the number
Telephone numbers
Capital cities of Australia
Multidigit
Approaching 2000

are all structured activities which provide students with practice at expressing numbers both in verbal and in written form. They are set in the practical contexts of dates, telephone numbers, quantities of money, and population figures.

These sessions also deal with the concepts and language associated with the ordering of numbers: greater or less than, first, second, third etc., which we might take for granted but need to be given attention with many adult students.

Another aspect of numbers dealt with in this section is that of estimation, or making reasonable guesses, and the related skills of rounding off numbers in order to make them more meaningful for communication purposes. These are introduced in the sessions:

How much do we know about each other?
Capital Cities of Australia
Estimating Time.

Other sessions: *Target score*
What's in a number?
Number patterns
Make a dollar
Understanding our number system

also focus on examining basic properties of number such as the ideas of odd and even numbers and the significance of place value (or how all numbers are constructed using only the ten single digits of our base ten number system).

Any of the sessions in Exploring Numbers can be used as opening, or 'getting to know you' activities when starting a class - particularly:

How much do we know about each other?
Stories with cards
Approaching 2000

and most of them are suitable as an activity to act as a break between other topics, particularly when some interaction and discussion is desirable.

STORIES WITH CARDS

Skills developed

- Use of language related to numbers

Materials

- Pack of playing cards

This is a further session in which students talk about everyday numbers in an informal and creative way. It again gives an opportunity for students to get to know each other.

SESSION OUTLINE

Deal 4 cards to a student. Ask them to tell a story about those numbers.

Some of the examples we collected are:

8	2	A	3

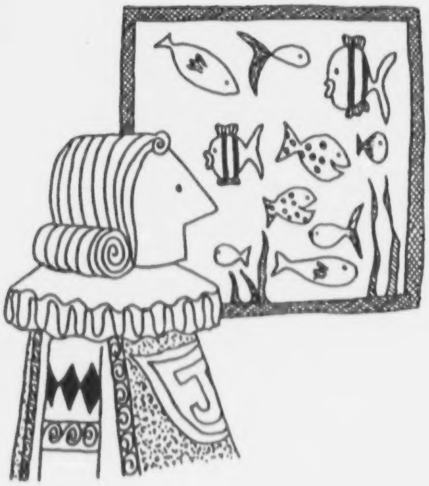
One girl had her 8th birthday on the third of the second and it was ace.

8	10	J	9

One day Jack was walking down the street and went to the pet shop where he saw 8 guinea pigs, 9 rabbits and 10 fish.

A	5	10	6

Brazil was behind 5-6 in the volleyball with only 10 people watching. Brazil took the ball and served an ace.



Note : Although they can add interest, you may choose to remove the picture cards.

Extension

Ask students to include at least **one** or **two** metric units in their story.

eg. Jack rode 9 kilometres to the pet shop where be bought 8 kilograms of dogfood for his 10 puppies.

APPROACHING 2000

Skills Developed

- Counting
- Using a time line

Materials

- Worksheet
- Coloured pens

In this session students can talk about the significant events in their life and represent them on a time line.

Some students may have had an early life which they wish to forget and this would not be a suitable exercise. You will need to know enough about the students to be able to judge whether it would draw the group together or be an isolating experience. Usually students are keen to share their experiences and want to know about each other.

SESSION OUTLINE

Start by asking:
"How many years is it until the year 2000?"
"What do you hope to be doing then?"

Now ask the students to date significant events in their life:
eg: birth
schooling
migration to Australia
working
children
sickness etc...

Students can discuss this in pairs which will provide a personal touch and a chance to share experiences. But explain that they do not have to discuss something if they do not want to.

Now ask the students to use the Worksheet to make a timeline of their life by filling in significant events and the year they occurred. The time lines can then be put side by side to compare their lives, noticing similarities and differences.

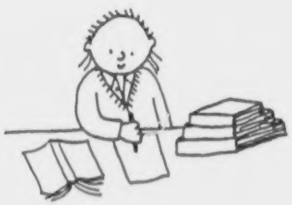
To make it more colourful and obvious they could use coloured shading to show their years at school, years overseas etc...

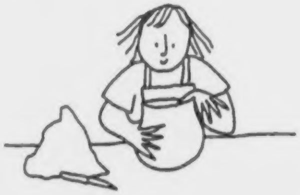
Then compare:

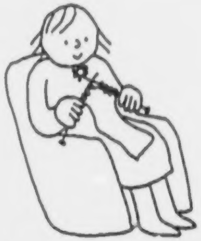
- *What were you doing at the age of 20? 15?*
- *What were you doing in 1965?*
- *What year were your children born?*
- *How many years since you went to school?*

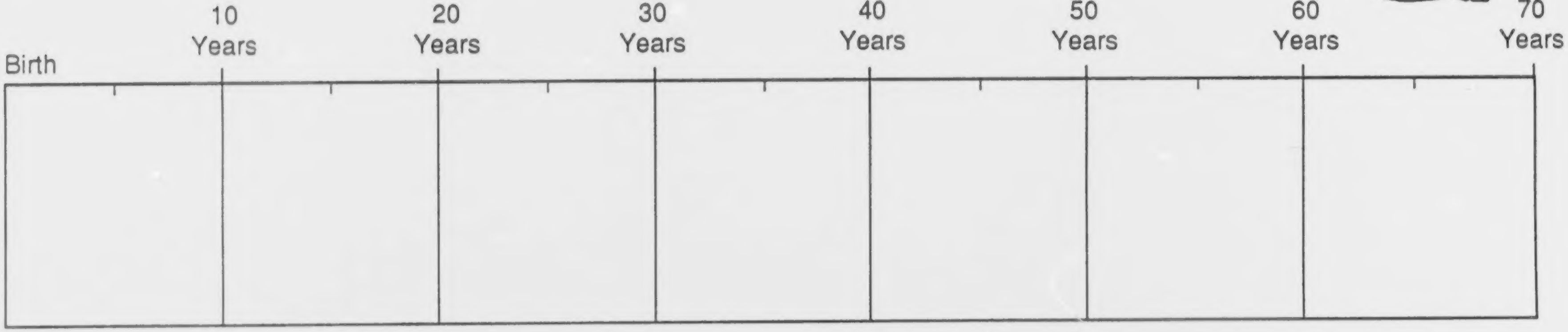
APPROACHING 2000

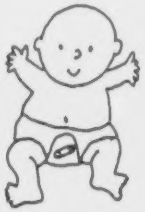
Worksheet

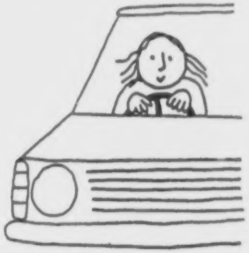


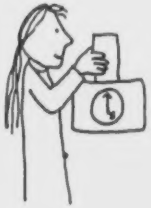


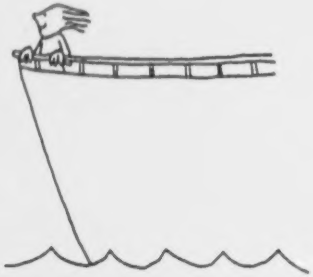



Birth
10 Years
20 Years
30 Years
40 Years
50 Years
60 Years
70 Years









TARGET SCORE

Preskills

- Simple addition or familiarity with use of a calculator for addition.

Skills Developed

- Recognition of the role of place value
- Addition practice

Materials

- Ten sided dice for each small group of 2 or 3

  or
- Playing cards for each group (ace to ten)

  or
- Small cards labelled 0 - 9
- Calculators (optional)

This session is a game which demonstrates the importance of the position of each digit in a number, ie. its place value. It is suitable for an introductory session and is also a useful lead-in to addition. The game can be played using a calculator as a tool or purely as a game for calculator practice.

SESSION OUTLINE

Choose a target number of 3 digits for the class eg. 156

Students work in groups of 2 or 3 and are competing against their group members to be the first to reach the target number exactly, without going over.

PROCEDURE

Student 1 throws the dice (or selects a card) eg. 7 shows, and decides to make it 70 rather than 7 or 700.

Student 2 takes his turn eg. throws a 2 and makes his decision on 2 or 20.

Now **student 1** has her second turn eg. throws a 9, and having decided on 9 or 90, adds together her two numbers so far.

Student 2's second turn now, and eg: he throws a 6.

Continue in this way until one student's total exactly reaches the target number.

If a number rolled will take a student over the target, they must pass e.g. if a student is on 153 and throws 4, they will have to wait for their next turn and hope for a smaller number.

If your students have difficulty with the additions, a calculator can be used.

The game is more fun if students are watching each others progressive totals.

Because there is a large element of luck - mathematical skill alone will not determine the winner - this game is suitable for a tutor and student to play together.

Alternative:
This game can be used as a calculator exercise.

Each student has a calculator and adds on their chosen number after throwing the dice.

First they will need to estimate whether the target will be overshot. If the student makes a mistake choosing the value of the digit then the last number entered may be subtracted and entered again.

MULTI DIGIT

Pre Skills

- Some knowledge of the significance of place value of digits

Materials

- 1 ten sided dice
- At least one calculator
- Worksheet

Skills Developed

- Understanding of place value
- Addition
- Verbalisation of large numbers
- Writing of large numbers in words
- Ordering large numbers

This session introduces a simple game which incorporates:

- Appreciation of place value for digits in large numbers.
- Reading aloud and writing large numbers in words
- Deciding on the relative values of numbers

SESSION OUTLINE

1. Students play individually.
2. The Worksheet has two different sized grids. Cut these in half and give each student a copy of the smaller grid to start with.
3. The teacher/tutor rolls the dice.
4. The aim of the game is to obtain the highest possible total at the end of each round.
5. The numbers students use depend upon the roll of the dice. Each time the dice is rolled the players put the number shown into one square of the grid according to the following procedure:

    - You roll the 10-sided dice, eg. 8 shows. Players must enter this in the only box in row 1 of the grid.

    - Roll the dice again, eg. 6. This time the players must choose which of the boxes in row 2 they should place the number in (in the first box it will be worth 60, in the second it will be worth 6). Remember they are looking for the highest number.

    - Roll the dice the second time for row 2, eg. 4. Players must now put this number in the remaining box of row 2.

    - Proceed in this way *completing each row before moving on to the next,* until all boxes in the grid are filled.

6. Students now add together all the numbers as in normal addition of numbers set out in columns (see illustration). Calculators should be on hand for students to whom this addition will be a problem, (addition is not the main aim of the exercise). Alternatively, students can help each other with the additions.

7. The next step is to encourage the students to read their numbers out loud. This is best done by a series of questions such as:

   - *Who thinks they might have the biggest number? What is it?*

   - *Does anyone have a higher number?*

   - *Does anyone have a number between these?*

   - *Who thinks they have the lowest?*

   The students should be reading the numbers in such a way that **6578** would be: **"six thousand five hundred and seventy-eight".**
   By listening to others reading their numbers, students should decide whether their own is bigger or smaller. However, if this seems too difficult you may wish to record the numbers on the board as they are read out.

8. Once you have practised with the small grid, move on and repeat the game on the bigger grid where larger numbers in the millions will be encountered.

Note: For some students a gradual increase in grid sizes might be more appropriate than jumping immediately to the larger grid. In this way you can assist them to develop the language of large numbers over a period of time by making the game a regular activity.

Extensions

- Ask students to arrange themselves in a line, according to their number, from the smallest to the largest.

- Allow students to practice at writing their numbers in words by asking them to write out a cheque for that amount of dollars.

Further practice at reading large numbers aloud can be gained by looking at *Tattslotto* or other lottery prizes in the paper.

Another session which encourages this skill is *Capital Cities of Australia* in the *Exploring Numbers* section.

MULTI DIGIT Worksheet

					ROW 1
					ROW 2
					ROW 3
					ROW 4
					TOTAL

								ROW 1
								ROW 2
								ROW 3
								ROW 4
								ROW 5
								ROW 6
								ROW 7
								TOTAL

HOW MUCH DO WE KNOW ABOUT EACH OTHER

Skills Developed
- Estimation
- Social Interaction

Materials
- Card or paper
- Pins or sticky tape

This session describes a group estimation and discussion activity. It is based on an original idea, Startling Statements, invented by the EQUALS team from U.S.A. - see acknowledgements. (For the more advanced version see *Mathematics: A New Beginning.*)

The activity is a good ice-breaking exercise, appropriate either when students are first getting to know each other or when introducing the concept of estimation for the first time.

PREPARATION

Cut card or paper approximately 15cm by 20cm.

Write a question of the type suggested in the Session Outline on each card. Questions should be written in large, easy to read lettering.

Make sure there are enough for one card for each student.

SESSION OUTLINE

Hang or attach a different question card to each student's back making sure that they do not see the question. Ask students to circulate, and record answers given to them by other students responding to the "mystery" question on their own back. Questions remain unknown by the wearer during the exercise so that guesses cannot be judged when given. This makes it easier for students to guess freely.

Each student should collect answers from about five other people (depending on your class size.) Make sure the questions are not read out loud as they are answered.

If you think that some of your group will have difficulty reading, you could go through each question first, reading them with the group. Then place the questions at random on the back of each student without them seeing.

When all answers have been collected the students sit down and take the question from their back. *Now* they may read their own question!

Some suggested questions for an Introductory Session:

"How many people in the room

- *were born in Australia?*
- *come by public transport?*
- *are grandparents?*
- *have 3 or more children?*
- *are .... supporters (insert a football team)?*

Suggested questions for a later session:

These questions could be used if the activity is done when class members know each other quite well. They should be answered about the person wearing the question.

- *How tall am I?*
- *How many hours TV did I watch last night?*
- *How many cups of tea do I drink each day?*
- *How long did it take me to come to class today?*
- *How long did the housework take me yesterday?*

When all the answers to a question have been collected, compare them to the actual answer. Discuss the reasoning behind students' guessed answers. Highlight the value of making guesses based on knowledge you *do* have, or your own experience. Sharing reasoning strategies will help individuals to improve their skills in estimating. It can also be a lot of fun.

ESTIMATING TIME

Skills developed

- Estimation of travelling times
- Reading timetables and maps

Materials

- Local bus or train timetables
- Street Directory
- Phone Directory yellow pages

This session provides suggestions for estimating the times of various journeys, local or long distance, by car or public transport. It is open ended and can be tailored to suit the interests of your group.

SESSION OUTLINE

Begin the session by asking:

> *You want to see a movie in town starting at 7.30 p.m. What time should you leave home?*

Have a discussion about their methods of travel and how long each takes.

eg. how long a train trip takes, the time to get to the station and then walk or tram in the city, or how long to go by car, park and walk to the theatre.

This could lead into a class discussion about public transport and travelling time. Some activities could be:

1. Get a local timetable for the bus or train. Find out how long a trip takes on your line, eg. into town.

   What train or bus would you need to catch to get into town by 10.00 a.m., 5.30 p.m. etc.?

2. You have to combine two trains, or a bus and a train etc. Get timetables of two lines, work out the time you need to catch a train at your station to meet a connection to .... (choose a place) to be there by 12 noon.

   What time would you have to leave?

3. A day's outing by public transport or car. Use a map of a country area in the street directory, or the front of the Yellow Pages phone directory. Calculate the total distance to be travelled, eg. a trip from Melbourne to Swan Hill.

How far is Swan Hill from Melbourne?
How long will it take to travel there by car, based on average speed?
Have you included rest stops? Allowed for possible delays?
How long would it take by public transport? (use timetables, telephone enquiries)
Is it quicker to drive or take public transport?

You could also discuss costs for such trips. This could include concession tickets, full fare, return fares, petrol costs.

4. A final activity could be the planning of a group excursion. Estimate times prior to going, and check these on completion of the trip.

NUMBER PATTERNS

Pre-Skills
- Some facility with the four basic operations: addition, subtraction, multiplication and division.

Skills Developed
- Pattern recognition
- Whole number operations
- Use of constant function on calculator

Materials
- Worksheets 1, 2, 3, 4
- Calculator

This session uses sequences of numbers, called number patterns, to provide practice with basic operations and to introduce another use of the calculator - the constant function. Number patterns can be used with a range of students as they can be made easy or quite challenging.

SESSION OUTLINE

Activity 1: Pattern Counting

This activity is done orally, with the group. Give the rule and then students take it in turn to continue the pattern. Start with a fairly simple example.

eg. Start at 50 and count in tens.
Start at 73 and count in fives for a more difficult pattern.

Ask students questions like -

- *What are some other common ways that we hear people counting? (eg. by 2's)*
- *How can you count coins? eg. counting out 20 cent pieces or 50 cent pieces.*
- *Apart from adding, how could you make the pattern increase?*
- *Can you make a pattern where the numbers go down?*
- *Can you think of a halving pattern? Start with a large number, eg 128, and divide by two.*

Activity 2 : Using the Calculator Constant Function

Students use calculators to create a number pattern. You will need to explain that the calculator will keep repeating the operation if you don't clear, but keep pressing $\boxed{=}$.

This is known as the constant function of the calculator.

eg. $\boxed{7}$ $\boxed{+}$ $\boxed{3}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ (10, 13, 16 ...)
+ 3 is constant

$\boxed{2}$ $\boxed{x}$ $\boxed{5}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ (10, 20, 40 ...)
2 x is constant

$\boxed{10}$ $\boxed{-}$ $\boxed{2}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ (8, 6, 4, ...)
- 2 is constant

$\boxed{1000}$ $\boxed{\div}$ $\boxed{5}$ $\boxed{=}$ $\boxed{=}$ $\boxed{=}$ (200, 40, 8 ...)
÷ 5 is constant

Warning:

1. If you keep dividing, you will reach decimal fractions, and if you keep subtracting you will reach negative numbers. It is advisable to avoid both these at this stage.

2. Some calculators have the constant number differently arranged from those explained above.

Calculator Game with Constants

If the students are interested in using the calculator constant function, here is a game to play in pairs (one calculator between each pair).

The aim is to find the constant function which has been put on the calculator by one player.

- **Player 1** puts a constant in the calculator by doing an addition without Player 2 seeing
  eg. $\boxed{5}\boxed{+}\boxed{6} = \boxed{11}$

- **Player 1** gives the calculator to **Player 2** *without clearing.*

- **Player 2** just keeps pressing $\boxed{=}$ until the pattern of the constant operation is guessed, ie. + 6

Activity 3: Finding Number Patterns

This is an oral activity, for a group of students or student and tutor.

- The first person says a number eg. 8.
- The next person says another number, eg. 12.
- The third person must now continue the pattern using the same rule eg. 16.

Continue for as long as it is challenging. Whenever a student stumbles ask other students to explain the rule and help them.

The patterns can be recorded on the board as you go to make it easier.

Students should now do **Worksheets 1, 2, 3 and 4. Worksheet 2** is more difficult. More challenging sheets can be found in *'Mathematics: A New Beginning'*

NUMBER PATTERNS Worksheet 1

Fill in the Missing Numbers:

1) 1 2 3 4 5 ___ 7 8 ___ ___ ___

2) 2 4 6 8 10 ___ ___ ___ ___ 20 ___

3) 5 10 15 20 25 ___ ___ ___ ___ 50 ___

4) 10 20 30 ___ ___ ___ ___ ___ ___ 100 ___

5) 20 40 60 80 100 ___ ___ ___ ___ ___

6) 25 35 45 55 ___ ___ ___ ___ ___

7) 30 60 90 120 ___ ___ ___ ___ ___

8) 34 44 54 64 ___ ___ ___ ___ ___

1991 Strength in Numbers: Goddard, Marr, Martin

NUMBER PATTERNS

Worksheet 2

Fill in the Missing Numbers:

1) 36 38 40 42 — — — — — —

2) 20c 40c 60c 80c $1.00 $1.20 — — —

3) 50c $1.00 $1.50 $2.00 — — — — —

4) 10c 20c 30c 40c 50c — — — — —

5) 5c 10c 15c 20c — — — — — —

6) $1.00 $1.20 $1.40 $1.60 — — — — —

7) $2.00 $2.05 $2.10 $2.15 — — — — —

NUMBER PATTERNS

Worksheet 3

Fill in the missing numbers

1) 1 3 5 7 ___ ___ ___ ___ ___ ___ ___
2) 4 8 12 16 ___ ___ ___ ___ ___ ___ ___
3) 6 9 12 15 ___ ___ ___ ___ ___ ___ ___
4) 22 20 18 ___ ___ ___ ___ ___ ___ ___ ___
5) 5 10 15 ___ ___ ___ ___ ___ ___ ___ ___
6) 20 24 28 ___ ___ ___ ___ ___ ___ ___ ___
7) 30 33 36 ___ ___ ___ ___ ___ ___ ___ ___
8) 100 90 80 ___ ___ ___ ___ ___ ___ ___ ___
9) $1.00 $1.15 $1.30 ___ ___ ___ ___ ___
10) 25 50 75 ___ ___ ___ ___ ___
11) 50 100 150 ___ ___ ___ ___ ___
12) 40 37 34 ___ ___ ___ ___ ___
13) 30 min 1 hr 1.5 hr ___ ___ ___ ___ ___
14) 89c 92c 95c ___ ___ ___ ___ ___

NUMBER PATTERNS

Worksheet 4

Fill in the missing numbers

1) 1,000 2,000 3,000 ___ ___ ___ ___ ___

2) 5 sec. 10 sec. 15 sec. ___ ___ ___ ___ ___

3) 45 min 50 min 55 min ___ ___ ___ ___ ___

4) 29 27 25 ___ ___ ___ ___ ___

5) 6 12 18 ___ ___ ___ ___ ___

6) 5 9 13 ___ ___ ___ ___ ___

7) 40 36 32 ___ ___ ___ ___ ___

8) 2 6 18 ___ ___ ___

9) 800 400 200 ___ ___ ___

10) $5 $10 $15 ___ ___ ___ ___ ___

11) $6.50 $6.75 $7.00 ___ ___ ___ ___ ___

12) 15 30 60 ___ ___ ___ ___ ___

13) 17 25 33 ___ ___ ___ ___ ___

14) 87 80 73 ___ ___ ___ ___ ___

15) 16 25 34 ___ ___ ___ ___ ___

WHAT'S IN A NUMBER?

Skills Developed
- Understanding some common properties of numbers.
- Familiarisation with language of numbers.

Materials
- Optional: MacQuarie Dictionary
- Activity 2: counters
- Worksheets 1, 2 and 3

4
15
7
12
1
11
10
19
9
6
16
17
18
8
14
13
5
20
21
3

Here is a short activity in which the group can explore the language associated with numbers at the same time as some of their basic mathematical properties. It will provide an excellent opportunity for people learning English to discuss idiomatic expressions.

SESSION OUTLINE

Activity 1: What's in a Number?

Ask each person to think of their lucky number or a number they like. It will be better to keep these below 20. Write these on small pieces of paper, fold up and place in a 'hat'. One person 'picks the lucky number'. Alternatively, just talk about each number in turn.

- *What is special about your number?*
- *What does the number remind you of?*

The group can suggest as many ideas as possible.

For example:

7 The number of days in a week, an odd number, 7 wonders of the world, the seven seas, seventh heaven, 7 year itch, its a prime number.[1]

5 Half of ten, prime number[1]· number of fingers, 5 days in a working week, five star hotel, five o'clock shadow, five senses, five is an odd number, 5=3+2 the sum of the first odd and first even number.

6 Sixth sense (intuition), numbers on a dice, hit a six (i.e. hit a ball to the boundary in cricket), a goal in football, 'go for a six', 6= 1+2+3 (the sum of the numbers which divide into 6).

Many of these have come from the *MacQuarie Dictionary.* For students who have difficulty spelling numbers you could provide a list to help them look up the dictionary. The discussion can provide some humour and a chance for non English speaking background students to talk about idioms in their language compared to those in English.

---

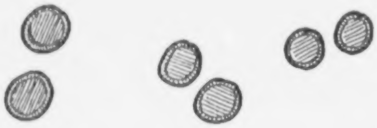
[1] The prime numbers are 2, 3, 5, 7, 11, 13, 17, 19, ...
They are numbers which have **no factors**, other than themselves and 1

Activity 2: The shape of Numbers?

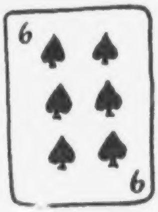
Consider one particular number, eg. 6

Take 6 counters.

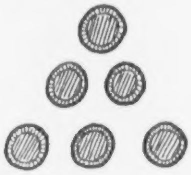
- *Can the counters be arranged in pairs?*
  Yes
  (NB: 6 is an even number)



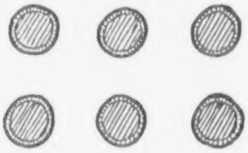
- *What does 6 look like on a playing card?*



- *Can you arrange 6 counters in a triangle?* Yes
  (NB: Each row of the triangle has one more counter than the row before)



- *Can you arrange 6 counters in a rectangle?* Yes
  (NB: This means 6 has factors 2 and 3. It therefore is *not* a prime number)

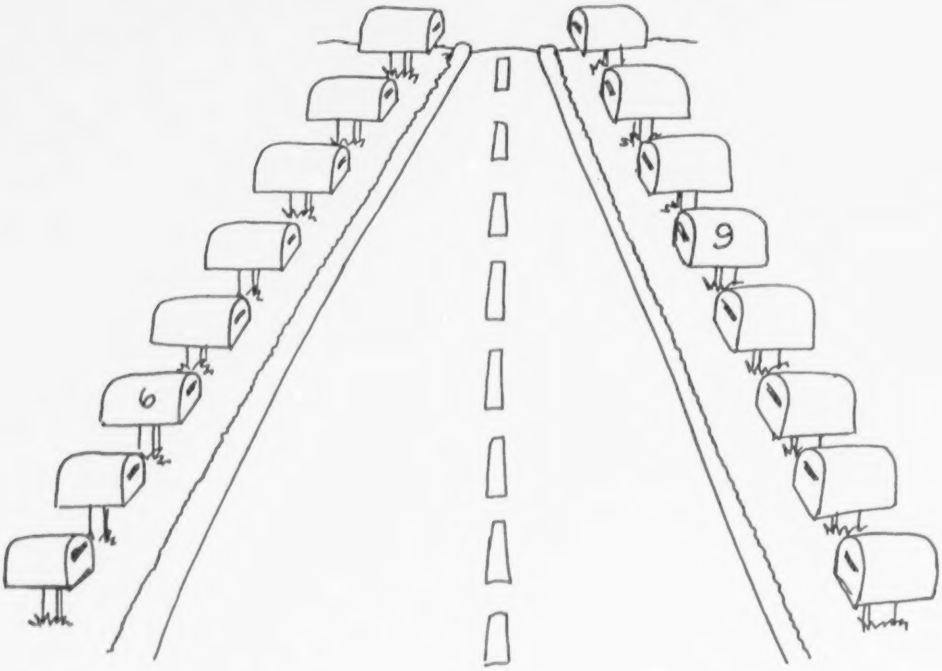


Now do **Worksheet 1, 2 and 3.**

WHAT'S IN A NUMBER
ODD & EVEN NUMBERS

Worksheet 1

1. Fill in the missing numbers on the letter boxes.



2. Label one side of the street EVEN and one ODD.

3. Which side of the street would the postman find these numbers (odd or even)?

13............

58............

101...........

30............

45............

93............

312...........

48............

67............

88............

39............

55............

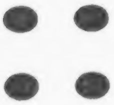
WHAT'S IN A NUMBER
NUMBERS WITH SHAPES

Worksheet 2

Give the next number:

SQUARE NUMBERS

1



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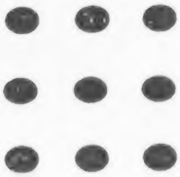

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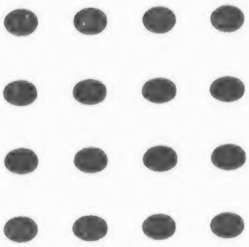

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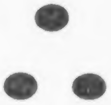
TRIANGULAR NUMBERS

1



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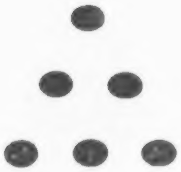

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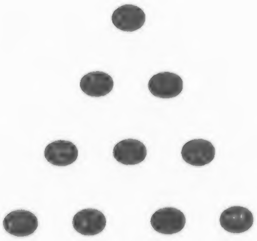

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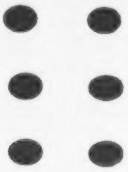
1991 Strength in Numbers: Goddard, Marr, Martin

WHAT'S IN A NUMBER
NUMBERS WITH SHAPES

Worksheet 3

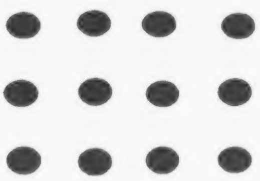
Here are some RECTANGULAR NUMBERS



6

6 is ______ rows of ______

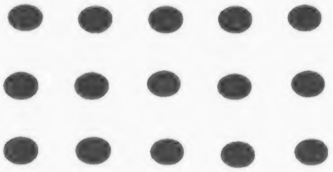
6 = ______ x ______



12

12 is ______ rows of ______

12 = ______ x ______



15

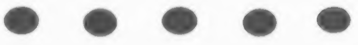
15 is ______ rows of ______

15 = ______ x ______

Can these be made into other shaped rectangles?

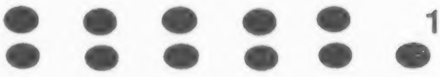
Do these shapes give new multiplication facts?

These are *not* rectangular numbers



5

These are **prime numbers**



11

Which of these numbers can you make rectangles with?

8 18 2 7 9 17 4

Draw the rectangles.
Write down the multiplication facts beside them.

CAPITAL CITIES OF AUSTRALIA

Skills developed

- Arranging numbers in order of size
- Rounding large numbers
- Knowledge of Australia
- Verbalising large numbers

Materials

- One atlas for the class
- Worksheets

In this session we use the map of Australia and the populations of Capital cities as a source of large numbers for students to practise ordering, verbalising and approximating, whilst raising their awareness about Australia.

PREPARATION

Make cards of the state names, capital city names, and populations by pasting Worksheet 1 on cardboard and cutting it out as shown. Have separate cards for names and populations.

SESSION OUTLINE

1. As a preliminary warm-up ask students to name the capital city of the country in which they were born. When you have established the meaning of 'capital' city proceed with the activity.

2. Working in groups of 3 or 4 give each group a Worksheet Map and the cards of **city names, state names** and **city populations.** Ask them to place the city in the correct position on the map, name the States, and try to fit the correct population with each city.

3. **Checking the positions**
   When they are all happy with their guesses, show each group the atlas to correct any incorrect positioning.

4. **Checking the Populations**
   To encourage students to articulate large numbers, ask people from several groups questions like:

   - *What have you decided was the population of Melbourne?*

   (The students should then attempt to say the number ie. two million, eight hundred and thirty two thousand, eight hundred and ninety three).

   - *Do other groups have different guesses for Melbourne?*

Note: the emphasis is on pronunciation of the numbers. You could write the actual number they say on the board.

Students who have been to other cities could talk about their knowledge which will help make decisions about relative sizes.

Don't tell students the actual figures until they have tried the next part of the activity.

5. **Arranging cities in order of population size**
Ask students to remove the cards of city names from the map and see if they can order them from largest to smallest.

After the students have made their guesses discuss the actual order:

Sydney, Melbourne, Brisbane, Perth, Adelaide, Canberra, Hobart, Darwin.

Now **to find the population** of each they will need to arrange the number labels in order.

If they are having difficulty arranging the numbers these pointers may help.

- there are 3 numbers greater than one million and they must be largest.
- one number has only 5 figures and must be smallest.
- for the 6 figure numbers ,arrange them in order by looking at the left hand side of the number (the thousands end).

Share the population cards out so that everyone takes part and let them arrange them in order, next to the cities.

Answer :	Sydney	3,364,858
	Melbourne	2,832,893
	Brisbane	1,149,401
	Perth	994,472
	Adelaide	977,721
	Canberra	248,441
	Hobart	175,082
	Darwin	72,937

Extensions

1. **Approximating**

   How would you actually talk about the population sizes in conversation?

   You would talk about 248,441 as being **about 200,000.** This approximate number we remember rather than the exact number. Ask them to give approximate populations of each city by "rounding" to the first figure as we did above.

2. **Population of States**

   Students may be interested in the population of the states and repeating the same activity on another day. Here are the figures:

   Population (1986 figures)

New South Wales	5,401,881
Victoria	4,019,478
Queensland	2,587,315
Western Australia	1,406,929
South Australia	1,345,945
Tasmania	436,353
A.C.T.	249,407
Northern Territory	154,848

   Also work out the total population of Australia (with a calculator) and round it off.

3. Compare these figures with a country relevant to your students or some neighbouring Asian countries.

Reference: There are many sources of more facts, for example:

The Australian Book of Facts
MacQuarie Illustrated World Atlas
Australian Almanac.

CAPITAL CITIES

Worksheet 1

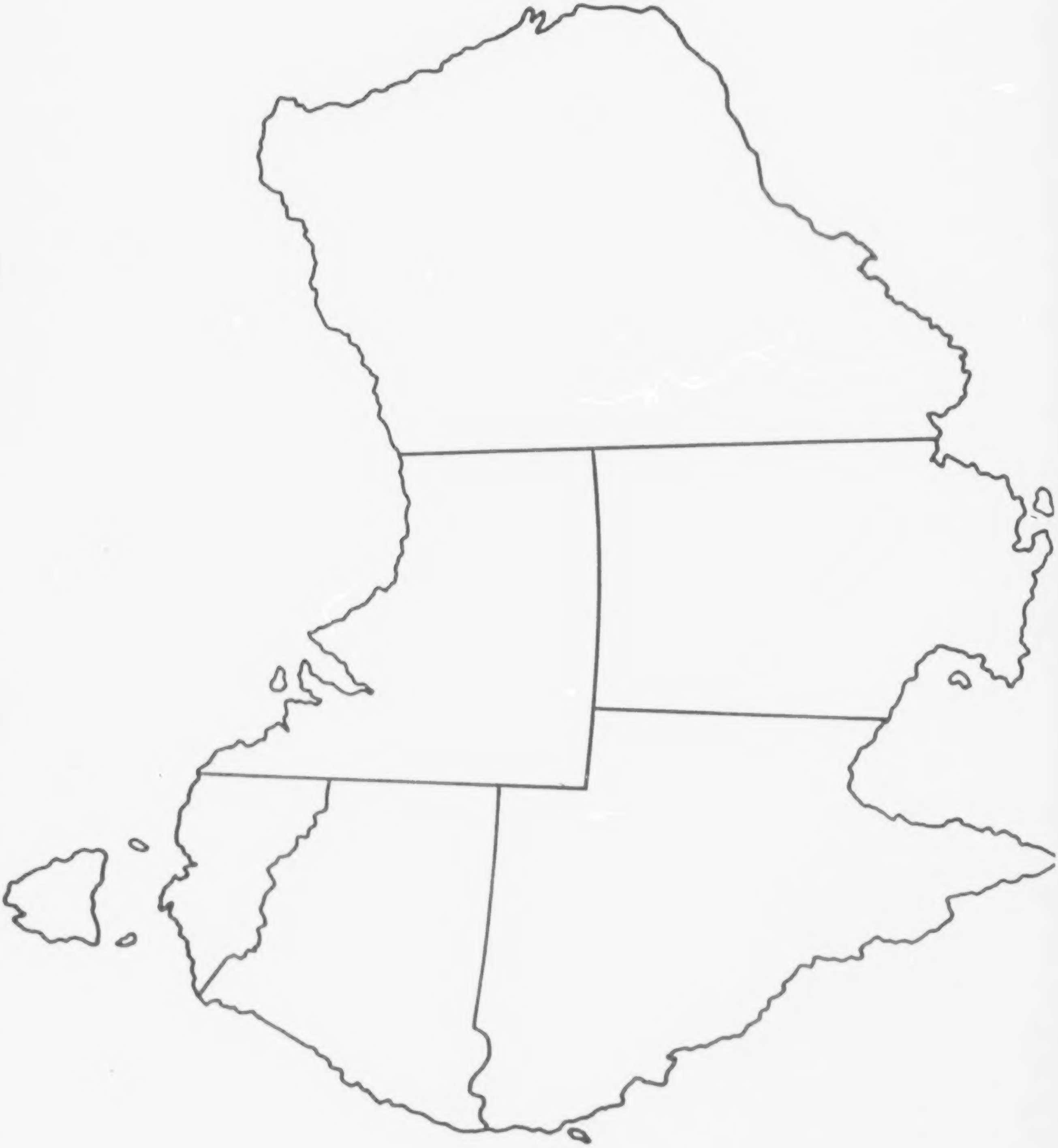
POPULATION ON 30 JUNE 1986

NEW SOUTH WALES	SYDNEY	3,364,858
VICTORIA	MELBOURNE	2,832,893
QUEENSLAND	BRISBANE	1,149,401
WESTERN AUSTRALIA	PERTH	994,472
SOUTH AUSTRALIA	ADELAIDE	977,721
TASMANIA	HOBART	175,082
AUSTRALIAN CAPITAL TERRITORY	CANBERRA	248,441
NORTHERN TERRITORY	DARWIN	72,937

SOURCE: THE AUSTRALIAN BUREAU OF STATISTICS

CAPITAL CITIES

Worksheet Map



TELEPHONE NUMBERS

Skills Developed

- Seeing patterns in numbers
- Writing numbers

Materials

- A number of cards with one phone number on each (Activity 1)

This session contains two activities which are related to the phone. Activity 1 is about remembering phone numbers and Activity 2 involves taking down phone messages which include numbers.

These seem simple exercises, but many students have trouble with these everyday skills.

SESSION OUTLINE

Activity 1: Remembering Numbers

Hold up a card with a phone number on it for 2-3 seconds and ask students to memorize it.

Ask students to write it down.

Start with 470 3355 and then 654 8297. After they have had an attempt with each number, discuss ways of memorizing them.

- *Which number was easier to remember? Why?*
- *Did you group the number in pairs or threes?*
- *What patterns do people use with their own phone numbers?*

Now hold up these numbers one at a time and ask students to try remembering them.

338 1333
338 0299
763 4424
427 0615
27 9217
347 9588

Note: Country areas and cities differ in the numbers of digits in a telephone number. Choose appropriate numbers for your group.

Extensions

1. Ask students to look at the Yellow Pages and find some business numbers which would be easy to remember.
2. You and the students can have fun with words and numbers by making up a business name and a number to match.

eg. Moon and Stars After Five Wear - 67 8900
Duo Dating Agency - 11 4411
Peter's Pear Orchard - 33 5566

Activity 2: Writing Numbers

Tell the students to imagine that they have answered the phone and have to take a message to pass on verbally to someone else.

You will read the message out loud to the students and they will need to write it down so that they do not forget it. They will be *reading out* the message to a third person so their note does not have to be written perfectly. It need only contain enough to enable them to get the numbers correct.

Here are some sample messages:

Message 1: Recipe for Spaghetti Bolognese

Half a kilogram of mince. Add a 470 gram jar of sauce and three quarters of a cup of wine. Cook for 15 to 20 minutes.

Message 2: Meet George on the second floor at five to one.

Message 3: The TV for sale is an AWA, 48 centimetres or 20 inches, it costs $299, there is a 10% deposit to hold it for you.

Message 4: Send your complaint to ACC, GPO Box 4306, Melbourne, Victoria, three thousand and one.

Procedure

Divide students into pairs and call one partner **A,** and the other B.

The **A** partners leave the room while you read the first two messages to the **B**'s and they take notes. **A's** return to the room and now the **B's** must repeat the message to the **A's** and they take down notes.

A's now read their messages back to you and you will have the task of unscrabbling any mistakes that have arisen. Now change around so that **B's** leave the room and you read out messages 3 and 4.

If you have an odd number arrange one group as two **A's** and a **B** and the second **A** can read their message to you.

They may each like to make up a message and read it out, to the group. Some students may need more practice with numbers such as two thousand and one (2001) which some students write as 20001, because they write the two thousand and then the one.

MAKE A DOLLAR

Preskills

- Ability to recognise coins and count money

Skills Developed

- Understanding of number system
- Exchanging coins for equivalent values

Materials needed

- 1 normal dice or ten sided dice
- A selection of coins
- Paper for drawing up charts (1 between 2 students)

This session presents a game which can be used to improve students' skills with money and at the same time demonstrates the ideas behind the formal methods of subtraction and addition.

The game can also be played at home with children.

SESSION OUTLINE

We recommend the use of real money rather than play money because the modern play money looks and feels quite different from the real thing.

One way to obtain a supply of coins for the activity is to ask the students to empty their pockets or purses of change (not $2 or notes) and to count it out. Record each student's amount to be returned at the end. This tends to make students feel more involved in the process and extra practice at money counting is also gained.

Demonstrate the game to the group by using one pair of students.

PREPARATION

Make up one chart for each pair of students on a piece of paper with columns large enough to hold coins.

1c	2c	5c	10c	20c	50c	$1.00

Put all the money in a pile on the table.

The players take turns throwing the dice and taking coins from the central pile to the value of the throw.

eg. if a 5 is thrown take **five 1 cent coins**, or **two 2 cent and one 1 cent or 5 cent piece.**

The coins are added to the chart under the correct column.

Whenever possible, the smaller coins are changed for a higher value coin.
eg.

1 c	2 c	5 c
○	○	
○	○	

Changed to

1 c	2 c	5 c
○		○

The aim is to replace all coins by a $1 coin. The winner is the first player to do so. Once you have demonstrated the game and it is clear to all students they can play the game in pairs or threes, using one chart for each group.

Variations

1. Use a ten sided dice to include a larger range of numbers.

2. Aim to make $2. This will take longer but would be suitable with a ten sided dice.

3. Use the game for subtraction by starting with $1 and taking away the value thrown aiming to reach 0.

4. To more closely model our number system, only use 1 cent, 10 cent and $1 coins, which correspond to units, tens and hundreds.

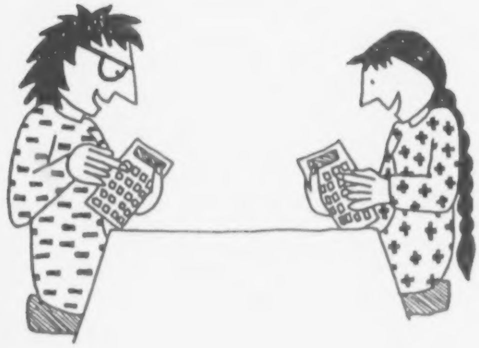
If you have MAB blocks you can play 'Make a Flat' using this procedure and singles, longs and a flat.

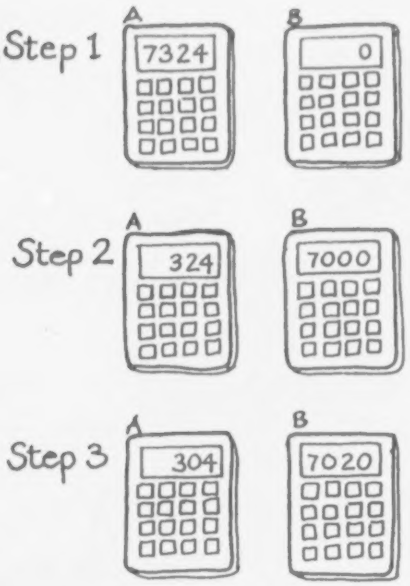
Units (Single Blocks)	Tens (Long Blocks)	Hundreds (Flat Blocks)

GUESS THE NUMBER

Skills developed
- Understanding of place value.
- Use of memory storage on calculator (optional)
- Verbalising numbers

Materials
- One calculator for each student





This number guessing game has three purposes. Firstly to enable students to realise the significance of the position, or place value, of the digits; secondly, to build their confidence in the use of calculators; and finally to provide practice in verbalising numbers.

SESSION OUTLINE

First demonstrate the game by asking one student, **player A** to write down a 4 digit number and put it on their calculator display. (Use 4 different digits to start with) eg. **7324**
Without seeing the number, **player B,** who has a calculator too, gradually discovers the whole number by asking questions about one digit at a time:

eg : **Player B:** *Have you got a seven?*

Player A: *Yes, I have seven thousand.*

Now **player A** subtracts 7000 ($\boxed{-}$ $\boxed{7000}$ $\boxed{=}$) leaving 324

Player B puts 7000 on their calculator.

Player B: *Do you have a two?*

Player A: *Yes, I have a twenty.*

On calculator: **Player A:** $\boxed{324}$ $\boxed{-}$ $\boxed{20}$ $\boxed{=}$

Player B: $\boxed{+}$ $\boxed{20}$ $\boxed{=}$

Continue playing in this way until player B has all 4 digits on the calculator and player A has none.
Player B then checks that the number he has on his display is the same as the number player A wrote down.

Remind them that 0 is also a digit.
eg. for the number 9052
Player B: *Do you have a zero?*
Player A: *Yes, I have a zero in the hundreds place.*

Using the calculator memory

Instead of writing down the first number it could be stored on the calculator memory. Show the students how to store a number in the memory following these steps:

1. Put the number in the display eg $\boxed{7324}$
2. Put 7324 in the memory: $\boxed{M+}$
   Note - M or a similar symbol appears in the display when there is something stored in the memory. This means you can use the calculator for other calculations whilst the number you stored is still in the memory.
3. Recall the memory using $\boxed{RM}$ or $\boxed{MR}$
   7324 will appear in the display, and still be stored in memory.
4. If you wish to remove a number from the memory, clear the memory with $\boxed{CM}$ or $\boxed{MC}$ or $\boxed{CA}$

To Continue The Game

Now **player A** chooses the number and stores it in memory using steps 1 & 2. When player B has guessed the whole number, player A may recall the memory (step 4) and both calculators should have the same number. Clear the memory before the next round.

Extensions

1. Make the game competitive by keeping a count of the number of guesses taken by each player. The player with the least guesses wins.
2. Repeat a digit eg. *"the number has 4 digits and one digit appears twice"*. This will be a harder version.
3. **Master Mind with Digits**
   The game 'Master Mind' is based on an old pencil and paper game where one player tries to guess a four digit number written by the other player.

   Example:
   Player A: writes a 4 digit number eg. 4576

   Player B: guesses a 4 digit number, writes it down for her reference, and reads it aloud eg. records 7836 and says: *seven thousand, eight hundred and thirty six.*

   Player A: responds by telling **B** that two digits are correct and one is in the right place.

   Play continues with **B** making deductions and **A** responding until the number is worked out. The players then switch roles.

   The aim of the game is to minimize the number of attempts required to arrive at the number.

B records:

Guess	No. of digits correct	No. of digits in right place
7836	2	1

UNDERSTANDING OUR NUMBER SYSTEM

Skills Developed

- Understanding the significance of:
  - place value in the ones and tens position
  - carrying from the ones to the tens column

Materials

- Drinking straws
- Rubber bands
- Manila folder
- Coloured card
- Dice

This session is a preliminary to a real understanding of the processes of addition with its "carrying", and subtraction with its "borrowing", expressions we use in a mechanical fashion but which are seldom understood by students or even teachers.

We use hands-on material to illustrate:

- the significance of place value in our base ten number system.
  eg the digit 6 has different values in the number 26, 162, 621.
- that 10 single objects can be replaced by a 1 in the ten's position.

PREPARATION

1. **Straws for a set of base 10 materials.**
   We have used drinking straws because they are cheap, easily available at the supermarket, colourful, light and easy to carry. Assemble a kit for each group of students as detailed below. The group should be small enough so that each student has a chance to use the materials - no more than 4.

   - Cut the straws in half (easy with scissors) bundle some together in groups of 10 with rubber bands, allowing approximately 50 single straws and 10 bundles of 10 straws per kit.

2. **Playing board.** Make a board by drawing up a piece of card (an open manila folder is a perfect size) as shown here:

Hundreds	Tens	Ones

Fold

3. **Number cards.** Cut pieces of card (preferably coloured) roughly 3cm x 3cm. Write one digit on each card, making 3 copies of each of the 10 digits 0, 1, 2 ,3, 4, 5, 6, 7, 8, 9.

SESSION OUTLINE

1. **Exploring the Materials**
   Give out a kit to each group of students and ask them to examine it before telling you what they have in front of them. Ask

   - *What's in the kit?*
     (Number cards, single straws, bundles of 10 straws, rubber bands and a playing board).

   - *What numbers are on the cards?*
     Discuss the fact that we only have digits (figures) from 0 to 9 and all numbers must be made by combinations of these digits.

2. **Modelling Numbers**
   Ask students to **represent numbers** in a variety of ways - with straws and with the number cards.
   eg:
   - *What card would you pick up to show six?* $\boxed{6}$

   - *What card(s) would you pick up to show eighteen?*
     More than 1 card needed - why? $\boxed{1}\boxed{8}$

   - *What is the biggest number we can make with just one card?* $\boxed{9}$

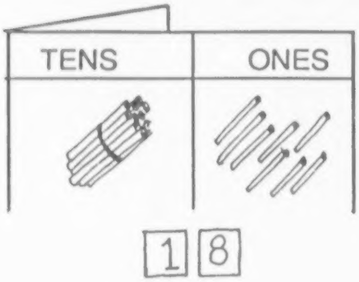
   - *How do you represent numbers larger than 9?*
     (you can compare this to counting on our fingers. We can count 1to10. But at 10 we must record somehow and start again.)

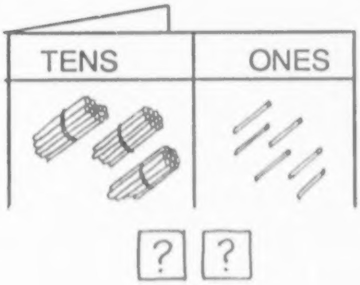
   This leads to a rule that 9 is the highest number of single straws which can be placed in the one's column.

Ask students to **model 18** with the straws and place the cards underneath. Explore this with questions like:

- *How many straws on the playing board altogether?*
- *How many in the singles column?* (8)
- *How many bundles of ten in the TENS column?* (1 bundle)
- *What does the 1 card mean?* (1 lot of 10)

Hundreds concealed by fold at this stage





Model another number, say 36 **using straws only** on the playing board.

Ask students to:

- *Put out the matching number cards.*
- *Say the number out loud* (thirty-six)

With students working in pairs ask one of them to model a number with straws for their partner. Their partner should then put the appropriate digit cards down and say the number. Then they can swap roles. Repeat until the students understand the system.

3. **Playing The Game 36**

We introduce this game with its aspect of competition in order to:

- encourage students to practice modelling numbers and
- introduce the idea of exchanging ten singles for one bundle of ten.

Materials

1 playing board for each pair
1 pair of dice
1 set of base 10 materials
Rubber bands

How to Play

4 players form 2 pairs, and each pair takes it in turn to roll 2 dice. (One member rolls the dice and the other member places straws on board according to the sum thrown).

After each throw the new straws are added to those already on the playing board. The winning pair is the one which reaches a total of 36 straws on the board or as close as possible to this target without going over.

Rules

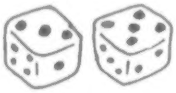
1. No more than 9 single straws can be placed on the 'ones' column (because we only have the digits 0-9 to represent numbers).
   10 singles must be exchanged for a single group of 10, and placed in the 'tens' column.

2. If you roll **doubles** you have that score **and** you can have **another turn.**
3. If you reach 30 or more you may choose to 'sit', and hope that your opponents do not get closer to 36 than you are, without going out.
4. Players can choose to count both or one die from the two thrown.

Note: Encourage students to verbalise what they are doing. For example:
"I'll take both numbers on the dice. That makes 7. ... I add 7 straws to the ones, which gives me twelve ... I have to make these into a group of ten and put them in the tens column".

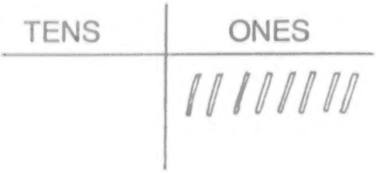
Example of Play

TEAM A - Play 1st



1st turn

- Roll 3 and 5 on two dice
- Put 8 singles on the board



- Hand dice to B team

2nd turn

- Roll double 5
- Put 1 bundle of 10
- Roll again 4 and 5
- Put 9 in ones
- Notice too many in ones
- Make bundle of 10 and carry to the tens column

3rd turn

- Roll 4 and 3
- Put 7 in ones column
- Change 10 singles for a bundle
- Notice how close they are to 36
- Decide to sit on 34

TEAM B - Play 2nd

1st turn

- Roll double 6
- Put 12 straws on the board
  - 1 bundle of 10
  - 2 singles
- Play again because of the double 6
- Roll 3 and 5
- Put 8 more on the board
- Notice 10 in the ones column and change them for a bundle of 10 which is carried into the tens column
- Give dice to A team

2nd turn

- Roll 5 and 6
- Put 10 bundle and 1 single

3rd turn

- Notice team A have 34
- Roll the two dice giving 2 and 5
- They take the 2 only because 6 would put them over 36

4th turn

- They must better 34
- roll 4 and 5
- Either would put them out so they concede defeat.

TEAM A WINS

EXPLORING NUMBERS Answers

NUMBER PATTERNS - WORKSHEET 1

1.	6, 7, 8, 9, 10, 11	(add 1)
2.	12, 14, 16, 18, 20, 22	(add 2)
3.	30, 35, 40, 45, 50, 55	(add 5)
4.	40, 50, 60, 70, 80, 90, 100, 110	(add 10)
5.	120, 140, 160, 180, 200, 220	(add 20)
6.	65, 75, 85, 95, 105, 115, 125	(add 10)
7.	150, 180, 210, 240, 270, 300, 330	(add 30)
8.	74, 84, 94, 104, 114, 124, 134	(add 10)

NUMBER PATTERNS - WORKSHEET 2

1.	44, 46, 48, 50, 52, 54	(add 2)
2.	$1.40, $1.60, $1.80	(add 20c)
3.	$2.50, $3.00, $3.50, $4.00, $4.50	(add 50c)
4.	60c, 70c, 80c, 90c, $1.00	(add 10c)
5.	25c, 30c, 35c, 40c, 45c, 50c	(add 5c)
6.	$1.80, $2.00, $2.20, $2.40, $2.60	(add 20c)
7.	$2.20, $2.25, $2.30, $2.35, $2.40	(add 5c)

NUMBER PATTERNS - WORKSHEET 3

1.	9, 11, 13, 15, 17, 19, 21	(add 2)
2.	20, 24, 28, 32, 36, 40, 44	(add 4)
3.	18, 21, 24, 27, 30, 33, 36	(add 3)
4.	16, 14, 12, 10, 8, 6, 4, 2	(subtract 2)
5.	20, 25, 30, 35, 40, 45, 50, 55	(add 5)
6.	32, 36, 40, 44, 48, 52, 56, 60	(add 4)
7.	39, 42, 45, 48, 51, 54, 57, 60	(add 3)
8.	70, 60, 50, 40, 30, 20, 10, 0	(subtract 10)
9.	$1.45, $1.60, $1.75, $1.90, $2.05, $2.20, $2.35, $2.50	(add 15c)
10.	100, 125, 150, 175, 200, 225, 250, 275	add 25)
11.	200, 250, 300, 350, 400, 450, 500, 550	(add 50)
12.	31, 28, 25, 22, 19, 16, 13, 10	(subtract 3)
13.	2 hr, 2.5 hr, 3 hr, 3.5 hr, 4 hr, 4.5 hr, 5 hr, 5.5 hr	(add 30 minutes)
14.	98c, $1.01, $1.04, $1.07, $1.10, $1.13, $1.16, $1.19	(add 3c)

NUMBER PATTERNS - WORKSHEET 4

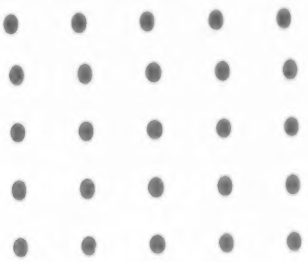
1.	4,000, 5,000, 6,000, 7,000, 8,000	(add 1,000)
2.	20 sec, 25 sec, 30 sec, 35 sec, 40 sec	(add 5 sec)
3.	1 hour, 1 hr 5 min, 1 hr 10 min, 1 hr 15 min	(add 5 min)
4.	23, 21, 19, 17, 15	(subtract 2)
5.	24, 30, 36, 42, 48	(add 6)
6.	17, 21, 25, 29, 33	(add 4)
7.	28, 24, 20, 16, 12	(subtract 4)
8.	54, 162, 486	(multiply by 3)
9.	100, 50, 25	(halve)
10.	$20, $25, $30, $35, $40	(add $5)
11.	$7.25, $7.50, $7.75, $8.00, $8.25	(add 25c)
12.	120, 240, 480, 960, 1920	(double)
13.	41, 49, 57, 65, 73	(add 8)
14.	66, 59, 52, 45, 38	(subtract 7)
15.	43, 52, 61, 70, 79	(add 9)

WHAT'S IN A NUMBER - WORKSHEET 1

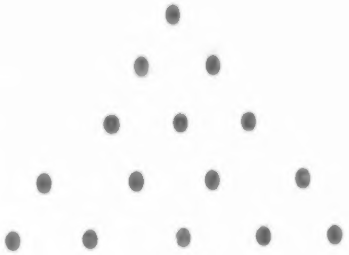
3.

13	ODD	312	EVEN
58	EVEN	48	EVEN
101	ODD	67	ODD
30	EVEN	88	EVEN
45	ODD	39	ODD
93	ODD	55	ODD

WHAT'S IN A NUMBER - WORKSHEET 2



25



15

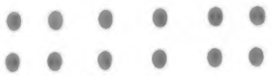
WHAT'S IN A NUMBER - WORKSHEET 3

6 is 2 rows of 3
6 = 2 x 3

6, no

12 is 3 rows of 4
12 = 3 x 4

12, yes

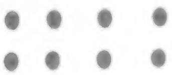


12 = 2 x 6

15 is 3 rows of 5
15 = 3 x 5

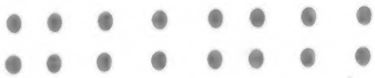
15, no

Can make rectangles with 8, 18, 9, 4

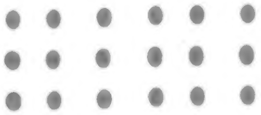


8

2 x 4 = 8

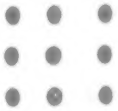


or



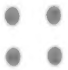
18

2 x 9 = 18
3 x 6 = 18



9

3 x 3 = 9



4

2 x 2 = 4

▸ ADDITION AND SUBTRACTION ◂

ADDITION AND SUBTRACTION
Introductory Notes

Addition and Subtraction are the most commonly performed mathematical calculations in everyday life. The students in your numeracy classes may cope with addition and subtraction in a variety of ways. Some will use laborious methods such as strokes on paper or counting on fingers. Some may perform the formal methods but have no real understanding of them. Other students may be totally dependent on calculators.

We consider there are several important aspects associated with the teaching of addition and subtraction.

1. Context and Language

One of the most important considerations, but most often neglected, is recognition of the contexts which require addition and subtraction. Often in our enthusiasm to teach the "how to" we forget the "why". It is no use learning the mechanical skills if students cannot recognise appropriate situations in which to use them. Hence our first session *"Food and Us"* uses a context close to everybody's heart — food — to introduce addition and subtraction in a "life" situation.

Throughout the other sessions we emphasise the value of "telling stories" to place addition and subtraction in a meaningful context. The final session, *Word Problems*, concentrates on addition and subtraction in everyday situations by providing many "word" problems.

The language associated with addition and subtraction is diverse — *add, total, more than, and, plus, greater than, increase, sum, difference, take away, reduce, minus, from, subtract, less than* etc. Throughout these sessions encourage your students to describe what they are doing. Verbalising will reinforce the link between the language of addition and subtraction and the mechanical process. It will also give you, the teacher, an opportunity to determine whether your students have understanding.

Of course we do also want to teach our students addition and subtraction by the most efficient methods, including both quick mental arithmetic and the formal written methods for more complicated calculations.

2. Informal Methods

Most useful daily life calculations done by adults are done in their heads. The usual written method is not the easiest way for mental calculations in which various "short cuts" can be employed. These involve having a firm grasp of basic addition facts such as 6 + 7 = 13. Knowing these addition facts is often overshadowed by the perceived need to know multiplication facts (ie. tables). In reality, the **addition facts** are probably more useful for life skills. We address this in the session *Learning Addition Facts,* and in *Subtraction in Stages* ways of doing subtraction in your head are looked at. In a later section of this book, *Money and Metrics*, there are further sessions focusing on mental calculations.

3. Formal Methods

To handle more complicated calculations proficiently, it is necessary to know the formal methods of addition and subtraction by columns. **"Carrying", "borrowing", "paying back"** may be familiar but confused concepts to your students. Effective learning of these formal processes can be achieved by the use of concrete materials, and so in the sessions *Building Addition Skills* and *Building Subtraction Skills* we use straws (or MAB blocks) to model and develop these methods.

FOOD AND US

Skills developed
- Language of addition and subtraction
- Application of addition and subtraction

Materials
- Calculator (optional)
- *Kilojoule Counter*

In this session, we use food (always of interest!) to introduce situations where addition and subtraction skills are needed. It is of topical interest to students because it concentrates on the differences between take-away and home-cooked food. Most Australians eat at least one take-away meal each week and generally these have a higher fat content than home-cooked meals - therefore a higher kilojoule count. Some students who have a particular interest in weight loss may have a good knowledge of kilojoules (or calories - 1 calorie is approximately 4 kilojoules). The names of food are common words on menus and in the supermarket and should not present a reading problem.

While doing these activities, you will be able to judge students' addition and subtraction skills and observe the methods they use, either with pen and paper, or with a calculator. You can introduce the language of addition and subtraction to describe what they are doing.

Note: It is not an issue here whether or not students use a calculator to do the calculations. The aim of this session is to look at the **language** and **application** of addition and subtraction, *not* to focus on the **method.**

SESSION OUTLINE

Either work as a whole group or divide into pairs. Give out copies of the *Kilojoule Counter.*

1. Ask the group (or pairs) to choose a typical or familiar **home-cooked meal** from the foods listed. Ask them to write down the food items and the kilojoule count and to work out the **total** number of kilojoules for the meal, using calculators if needed. The number of kilojoules measures the amount of energy in the food.

2. Next, ask students to choose a **take-away meal** and repeat the process of adding up the kilojoules.
   The take-away meal will probably have a much higher count than the home-cooked meal. When you have the totals for a number of meals you can discuss these questions:

- *What is the difference in kilojoules between the take-away meal and home-cooked meal?*
- *What sort of meal has the highest kilojoules and what has the lowest?*
- *Why is a take-away meal higher in kilojoules?*

Note: Usually this is because of a high fat content - fat is high in kilojoules ie. energy. A lot of take-away meals can cause people to become overweight because the food is high in kilojoules but low in fibre. A lack of dietary fibre means that the food is not so filling.

- *When would you be interested in high energy meals and low energy meals?*

Note: You would need a high energy meal when you are doing a lot of exercise or hard physical work. (Up to 16,000 kJ per day). When you are inactive or trying to lose weight you would need less energy from food (about 6,000 kJ per day). If you eat high energy meals and are inactive, you will gain weight.

Further Activities and Extensions

1. **High fat or low fat foods**

   Nutritionists say that our diet is too high in fat, sugar and salt.

   Choose some items from the *Kilojoule Counter* where there is a high fat / low fat alternative or high sugar/low sugar. What is the **difference** in kilojoules in each case? Some suggestions are:

   - chips compared with boiled potato
   - chicken with skin and without
   - soft drink compared with water
   - slice of cheddar cheese (335kJ) and 1 tablespoon ricotta cheese (140kJ)
   - flavoured yoghurt and plain yoghurt

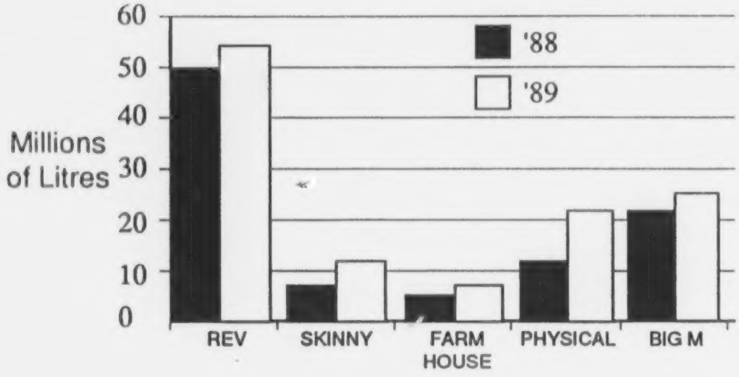
2. **Weight loss**

   If students are particularly interested in dieting then you could work out 3 possible meals for a day. Divide the suggested 6000kJ between the 3 meals and use the *Kilojoule Counter* to work it out. Include a variety of food. This number of kilojoules should result in a weight loss of half to one kilo per week.

3. Endless ideas

Food can provide many ideas for basic maths.
Newspapers and magazines often have graphs and articles about food which can be made into a class exercise.

eg. SPECIAL VARIETIES OF MILK



Packaging often has many facts and figures,
eg. bread wrapper gives:

- number of slices
- nutritional information.

You could compare varieties of bread for these things,

- cost per slice
- number of sandwiches you could make etc.

Keep any useful information you see and then introduce it at appropriate times.

There are many interesting reference books. Here are two:

- ***Food and You, a Commonsense Approach to Nutrition*** by Rosemary Stanton, published by Holt, Rinehart and Winston 1984.
- ***Food, What's In It, A to Z of Food and Nutrition*** by Catherine Saxelby, published by Reed Books, 1989.

KILOJOULE COUNTER

Kilojoule count per average serve:

MEAT, CHICKEN, FISH

Steak (no fat)	1000kJ
Chicken (no skin)	660
(with skin)	1005
Fish	584
Lamb cutlet	308

SALAD

Lettuce	5kJ
Celery	61
Tomato	73
Cucumber	8
1/2 avocado	920

PASTA, RICE, BREAD

Pasta	885kJ
Pasta & tomato sauce	1050
Pasta & cream & mushroom sauce	1680
Boiled rice (1/2 cup)	380
1 slice bread	270

ICE-CREAM, YOGHURT

Icecream (2 scoops)	540kJ
200g carton Yoghurt	
(flavoured non fat)	668
(plain non fat)	566

DRINKS

1 can soft drink	680kJ
1 can beer (5% alcohol)	590
1 glass wine	400
1 glass fruit juice (unsweetened)	225

TAKE-AWAY

Hamburger	1800kJ
Meat pie	1646
Chips	1008
Pizza (thick)	4072

VEGETABLES

Potato (boiled)	335kJ
(roast)	670
Pumpkin	228
Carrot	108
Capsicum	24
Cabbage	46
Zucchini	76

FRUIT

1 apple	308kJ
1 banana	430
1 pear	356
Serve strawberries	81
Serve rockmelon	110
1 orange	265

CHEESE

1 thick slice cheddar cheese	588kJ
1 tblsp ricotta cheese	140

1991 Strength in Numbers: Goddard, Marr, Martin

LEARNING ADDITION FACTS

Skills Developed
- Automatic recall of addition facts for numbers 0 to 9.

Materials
- Counters
- Two 10 sided dice (see Appendix)
  or
  Pack of cards (without picture cards)
  or
  10 sided spinner
- Worksheets 1, 2, 3

In this session there are a variety of activities and games, group and individual, to generate the addition facts using the numbers 0 to 9, eg. 6+5=11, and give practice in memorising and recalling them.

Students are often conscious of not being able to remember multiplication tables but the same attention is not given to automatically recalling addition facts even though these are probably more necessary. Without knowing them the student has to count, use strokes, or rely on the calculator which can be slower and contribute to a lack of confidence.

The addition facts for numbers up to 10 are essential, and once given some methods for learning them, it should not be too difficult for a student to extend them to numbers up to 20.

These activities can be used in any order. To give regular practice of addition facts one or two could be used in each class time. They are good short activities and can provide a break from other sessions.

- **Activities 1 and 2** are for learning the adding combinations that give 10, eg: 3 + 7 = 10
- **Activities 3,4 & and 5** are to learn the addition facts when adding together two numbers from 0 to 9.

SESSION OUTLINE

Activity 1: Addition Combinations which give 10

Materials
- Counters (or blocks, matchsticks etc.)
- Worksheet 1

If a student knows the addition combinations which give 10, higher additions can be worked from 10.

eg. 9+7 can be regarded as 9+1=10 and 6 more make 16.

These facts can also be useful with money.

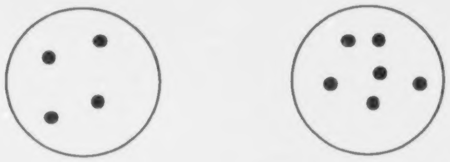
eg 6+4=10 is easily extended to 60+40=100
or 60c + 40c = $1

eg Approximate values of change can be calculated:
39c from $1 is about 60c.

Give out 10 counters to each student, and a copy of **Worksheet 1**.

Ask them to use all 10 counters to fill the two circles at the top of the Worksheet.

eg



Have them record their arrangement by filling in the boxes below the circles.

eg

$$\boxed{4} + \boxed{6} = 10$$

Repeat for as many different arrangements as possible. (Don't forget 10+0=10!).

Activity 2: 'This goes with that!'
(Practising Adding Combinations that Give 10)

Materials
- 10 sided dice

Students work in pairs or individually. In turn they throw the dice to choose a number from 0 to 9, and then their partner says the other number which makes a total of 10. eg. throw 6, partner says 4. The aim is to do the activity verbally and quickly enough to work towards an automatic response.

If done alone, the student throws the dice *and* provides the answer.

Activity 3: Be Ace at Adding
(Practicing addition of One Digit Numbers)

Materials
- Two 10-sided dice

or
- Pack of playing cards (picture cards removed)

This is an activity best done on a one-to-one basis with the student and tutor to provide quick practice at recalling addition facts.

The student throws the two dice, adds together the two numbers shown (preferaby by memory rather than counting) and states the answer.

Alternatively: the two numbers can be generated by choosing 2 cards from a pack.

You can provide instant feedback to the student on the correct answer and also pick out any facts which are repeatedly weak for the student.

If a student needs this practice and you haven't time to sit and check the answers, ask the student to write down the numbers shown on the cards or dice and quickly write the answer. You can check them later.

Materials

- Worksheet 2
- Worksheet 3
- Two 10-sided dice

Activity 4: Addition Tables

Students fill in table on **Worksheet 2.** This completed sheet can be kept as a reference.
Students may not be familiar with a grid layout and some explanation may be needed on how to fill it in.

Suggestion:

- If students fill this grid in row by row, it can become an exercise in **counting,** rather than **adding two numbers.** To avoid this, throw two 10 sided dice and call the pairs of numbers. Students can then add these two numbers and fill in the total in the relevant box.

Other variations:

- Students make up their own small grid or use those provided on **Worksheet 3,** and fill them in using numbers they find difficult.

eg.

+	0	9	7	5
6				
7				
8				

These can be used for practice at any time, particularly at home.

Materials

- Coloured card
  or
  index cards

Preparation

- Cut card into pieces approx 10 x 3cm or use precut index cards or blank invitation cards from the newsagents

Activity 5: Adding in a Flash (Memorising Addition Facts)

Help students make their own flash cards on addition facts they have trouble with:

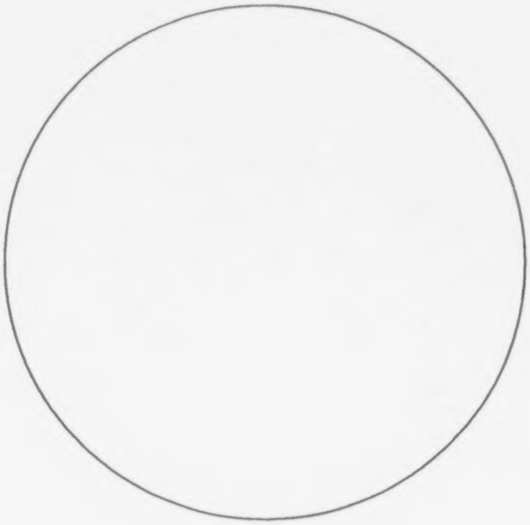
example: **7 + 5 =** **side I**

7 + 5 = 12 **side II**

To use these:
Students place their cards in a pile, **side I** uppermost. They take the top card, read it and give an answer. Check the answer instantly on **side II** by turning the card. If correct, put the card aside. If not, return to the bottom of the pile. Repeat with next card etc.
As students become more proficient they have the satisfaction of seeing their pile getting smaller.

LEARNING ADDITION FACTS

Worksheet 1



☐ + ☐ = 10

☐ + ☐ = 10

☐ + ☐ = 10

☐ + ☐ = 10

☐ + ☐ = 10

☐ + ☐ = 10

☐ + ☐ = 10

☐ + ☐ = 10

☐ + ☐ = 10

☐ + ☐ = 10

☐ + ☐ = 10

☐ + ☐ = 10

ADDITION FACTS

Worksheet 2

+	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

ADDITION FACTS

Worksheet 3

Fill in the blank squares by adding a number at the side and a number along the top.

+	0	9	6	5
7			13	
8				
3		12		
5				

+	1	5	8	
4				
2				
7				

Fill in your own numbers:

BUILDING ADDITION SKILLS

Pre-skills
- *Understanding Our Number System*

Skills developed
- Formal method of addition in columns

Materials
- Drinking straws cut in half and Elastic bands
  or
- MAB base 10 blocks (see Appendix)
- Manila folders (or card) for making an 'Operations Table'
- Worksheets 1, 2

This session uses straws or MAB blocks (use whichever you are happy with) to develop the formal method of addition by columns.

eg. 153 + 278 becomes:

$$\begin{array}{r} 153 \\ \underline{+{}_{1}2\,{}^{}78} \\ 431 \end{array}$$

It is aimed at students who:

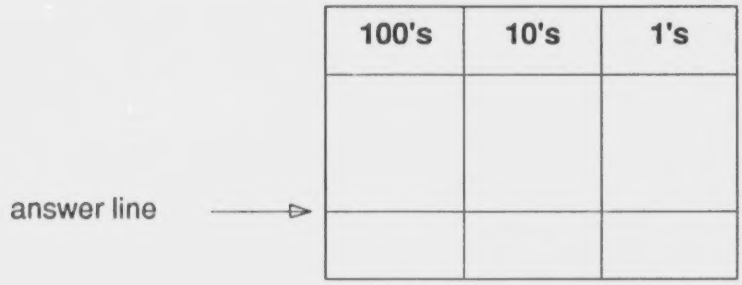
(i) cannot do addition by columns

or (ii) **can** do addition by columns, but do not understand the process.

Students who cannot perform this addition method may be hampered by a lack of proper knowledge of place value, and confine themselves to counting. Plenty of experience with concrete materials should take them closer to understanding the method and eventually doing addition, and later subtraction, by formal methods.

SESSION PREPARATION

'Operations table' as illustrated here.
A manila folder opened out flat is a good size.



SESSION OUTLINE

Below are 4 worked examples using straws and MAB blocks, which you can use to demonstrate addition by columns to your students.

The order of the examples is:

1. tens and units, no carrying eg. 12 + 35

2. tens and units, with carrying eg. 25 + 47

3. hundreds, tens and units, no carrying eg. 351 + 124

4. hundreds, tens and units, with carrying eg. 343 + 178

We have included in the text only one example of each type to illustrate the approach. However, when working with your students, it will be necessary to demonstrate a number of examples. Following the worked examples is a list of graded examples you can use for further practice.

It is important to link the **language** associated with addition to the mechanical process. When working through these examples with your students, *verbalise* what you are doing at each step. Encourage your students to do likewise when they are using the straws to solve an addition problem. Ask students to tell stories to go with each example.

eg. 12 + 35

> *There were 12 people in a cafe and a busload of 35 more people arrived. The waitress now has 47 people to serve.*

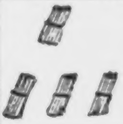
The 4 worked examples below have the numerical steps written alongside each stage of the straw work. When demonstrating these examples to your students, start by using *only* straws and verbal descriptions of the steps. Allow students plenty of practice at describing the operation out loud as they perform it, before moving on to the written representation of the steps.

Example 1: (tens and units; no carrying)

12 plus 35

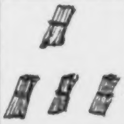
An example of a 'story' could be :
There were 12 people in a cafe and a busload of 35 people arrive.
How many people does the waitress now have to serve?

Using straws

100's	10's	1's
		// /////

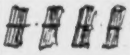
$$\begin{array}{r} 12 \\ +\ 35 \\ \hline \\ \hline \end{array}$$

Represent the 2 numbers on the 'operations table'

100's	10's	1's
		
		///////

$$\begin{array}{r} 12 \\ +\ 35 \\ \hline 7 \\ \hline \end{array}$$

Addition is a 'gathering together' so bring together all the straws in the units column and place them below the 'answer line'

100's	10's	1's
		///////

$$\begin{array}{r} 12 \\ +\ 35 \\ \hline 47 \\ \hline \end{array}$$

Now gather together the 10's. Read off the new number that results ie. 47

Using MAB

100's	10's	1's
	▮ ▮▮▮	■■ ■■■■■

100's	10's	1's
	▮ ▮▮▮	
		■■■■■■■

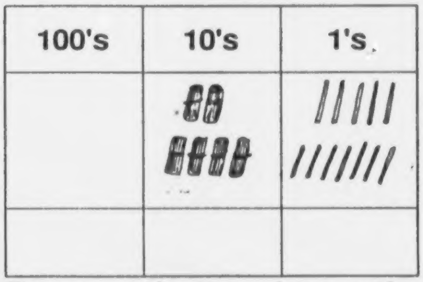
100's	10's	1's
	▮▮▮▮	■■■■■■■

Example 2: (tens and units; with carrying)

25 plus 47

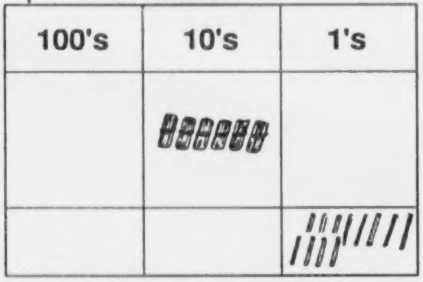
Hugo spent $25 on a shirt and $47 on jeans.
How much did his new clothes cost?

Using straws

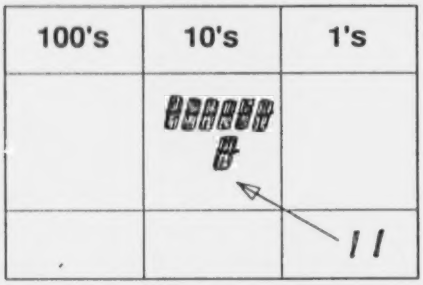


$$\begin{array}{r} 25 \\ +\ 47 \\ \hline \\ \hline \end{array}$$

Represent the 2 numbers on the 'operations table'

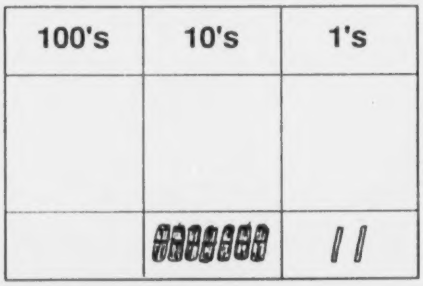


'Gather together' the straws in the units column and place them below the "answer line".



$$\begin{array}{r} 25 \\ +\ {}_{1}47 \\ \hline 2 \\ \hline \end{array}$$

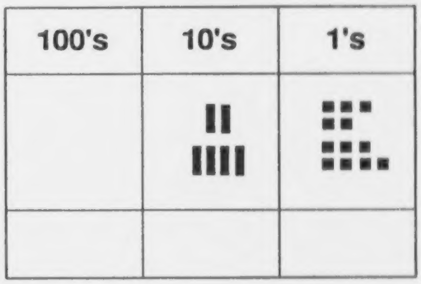
Regroup the units by bundling and tying 10 straws from the units column, then 'carry' the bundle into the 10's column.

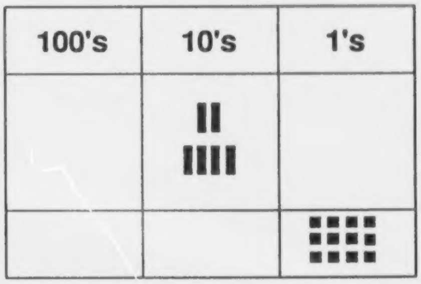


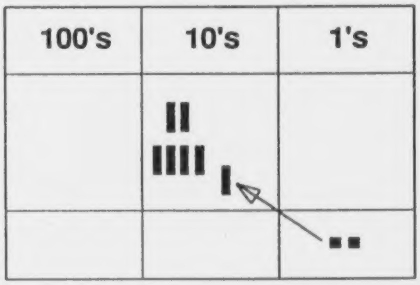
$$\begin{array}{r} 25 \\ +\ {}_{1}47 \\ \hline 72 \\ \hline \end{array}$$

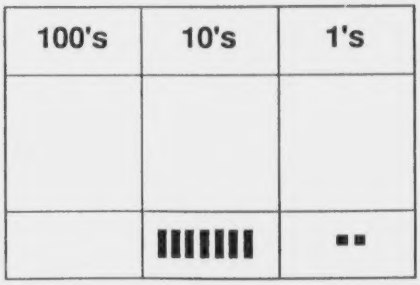
'Gather together' the tens.
Read off the new number ie. 72

Using MAB









More examples for further practice :

I Tens and units, no carrying

1. 27 + 31 2. 46 + 43
3. 50 + 25 4. 18 + 71

II Tens and units, with carrying

1. 19 + 33 2. 57 + 13
3. 46 + 25 4. 82 + 29

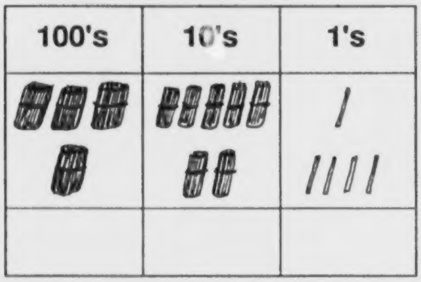
Students can now do **Worksheet 1.** Make sure that all students can demonstrate the use of straws or MAB blocks to solve these.

Some students may need to continue with the concrete material and should be encouraged to use it as long as it is needed.

Example 3: (Hundreds, tens and units; no carrying)

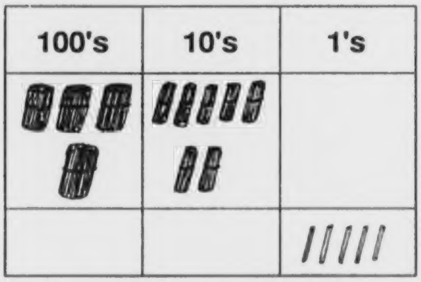
351 plus 124

Using straws



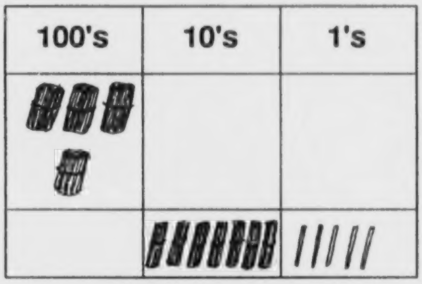
$$\begin{array}{r} 351 \\ +\ 124 \\ \hline \\ \hline \end{array}$$

Represent the 2 numbers



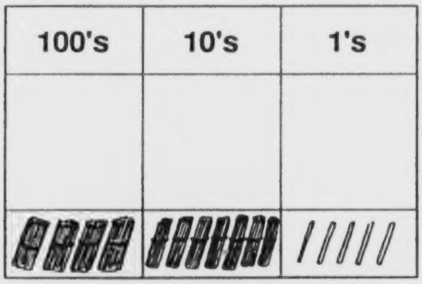
$$\begin{array}{r} 351 \\ +\ 124 \\ \hline 5 \\ \hline \end{array}$$

'Gather together' the units



$$\begin{array}{r} 351 \\ +\ 124 \\ \hline 75 \\ \hline \end{array}$$

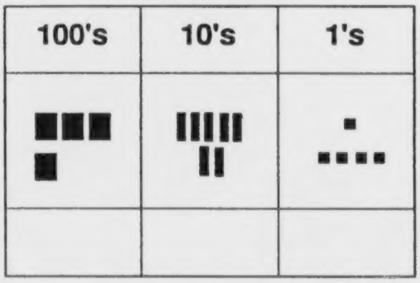
'Gather together' the tens

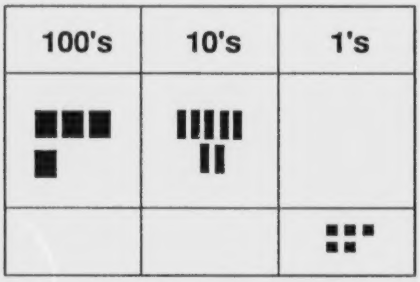


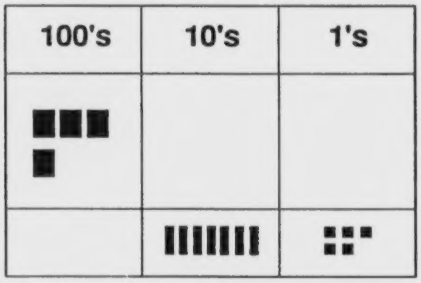
$$\begin{array}{r} 351 \\ +\ 125 \\ \hline 475 \\ \hline \end{array}$$

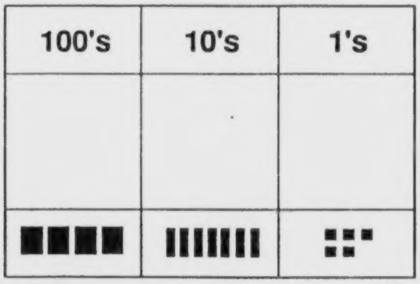
'Gather together' the hundreds.
Read off the new number ie. 475

Using MAB





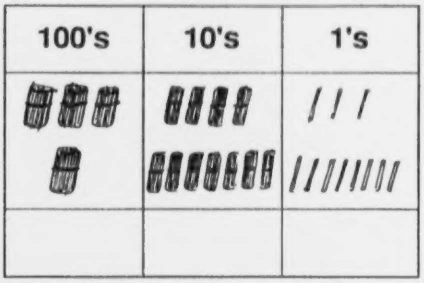




Example 4: (Hundred, tens and units; with carrying)

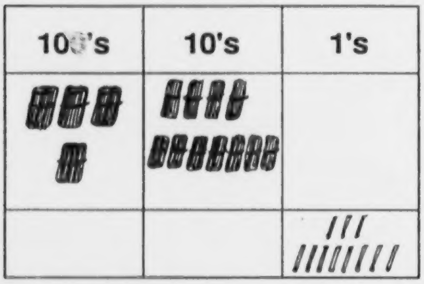
343 plus 178

Using straws

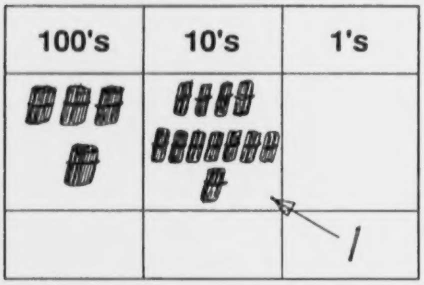


$$\begin{array}{r} 343 \\ +\,178 \\ \hline \\ \hline \end{array}$$

Represent the 2 numbers

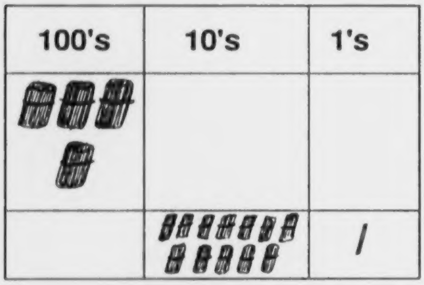


'Gather together' the units



$$\begin{array}{r} 343 \\ +\,1_{1}78 \\ \hline 1 \\ \hline \end{array}$$

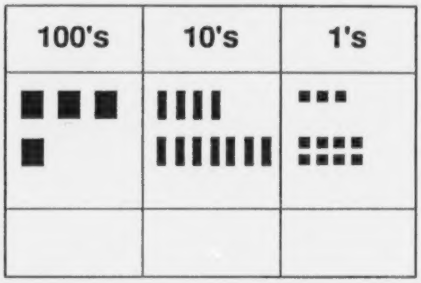
Regroup the units.

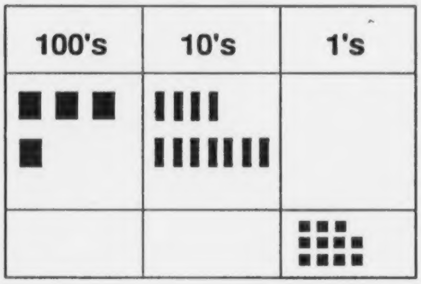


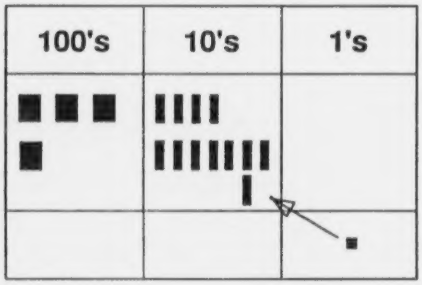
$$\begin{array}{r} 343 \\ +\,178 \\ \hline 1 \\ \hline \end{array}$$

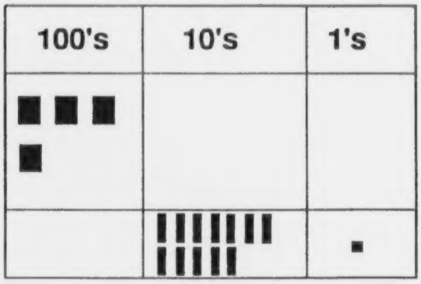
'Gather together' the tens.

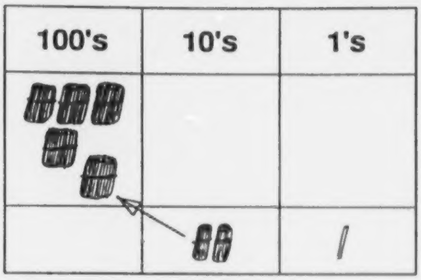
Using MAB



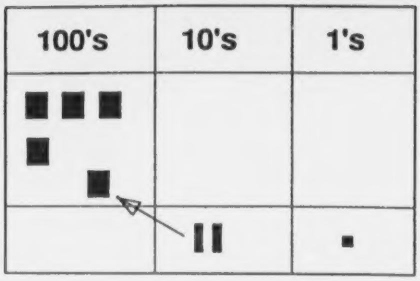




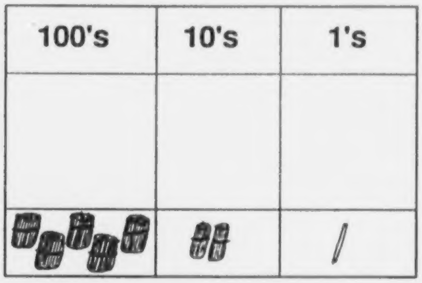




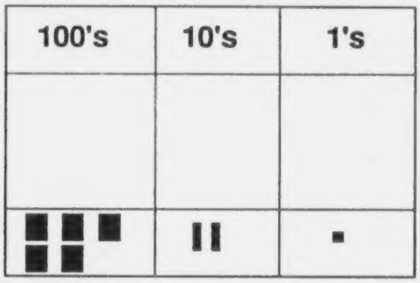
$$\begin{array}{r} 343 \\ +\ {}_{1}1{}_{1}78 \\ \hline 21 \end{array}$$



Regroup the tens.



$$\begin{array}{r} 343 \\ +\ {}_{1}1{}_{1}78 \\ \hline 521 \end{array}$$



'Gather together' the hundreds.
Read off the new number ie. 521

More examples for further practice:

A. hundreds, tens and units, no carrying

1. 123 + 321
2. 327 + 51
3. 455 + 104
4. 500 + 187

B. hundreds, tens and units, with carrying

1. 256 + 117
2. 173 + 257
3. 489 + 235
4. 338 + 394

Students can now do **Worksheet 2.**

BUILDING ADDITION SKILLS

Worksheet 1

1. (a) $\begin{array}{r} 12 \\ +\ \underline{25} \end{array}$ (b) $\begin{array}{r} 81 \\ +\ \underline{14} \end{array}$ (c) $\begin{array}{r} 27 \\ +\ \underline{30} \end{array}$

2. (a) 13 + 52 (b) 52 + 21 (c) 45 + 48

3. (a) 25 more than 14 is ....?
   (b) 18 more than 79 is..............................?

4. Find the total of 18 and 23.

5. (a) What is the sum of 27 and 17?
   (b) What is the sum of 51 and 29?

6. (a) Add 78 to 12
   (b) Add 35 and 42

7. What is the total of 12, 23 and 56?

8. Add 39, 40 and 12 together.

BUILDING ADDITION SKILLS

Worksheet 2

1. Add 123 and 340

2. (a) $\begin{array}{r} 451 \\ +\ \underline{127} \end{array}$ (b) $\begin{array}{r} 180 \\ +\ \underline{217} \end{array}$ (c) $\begin{array}{r} 668 \\ +\ \underline{202} \end{array}$

3. Find the sum of 374 and 123

4. Do these additions:

   (a) 127 + 318
   (b) 356 + 125
   (c) 89 + 112
   (d) 526 + 107
   (e) 443 + 277

5. 263 more than 128 is..?

6. Find the answers to these additions:

   (a) $\begin{array}{r} 127 \\ +\ \underline{386} \end{array}$ (b) $\begin{array}{r} 452 \\ +\ \underline{137} \end{array}$ (c) $\begin{array}{r} 708 \\ +\ \underline{154} \end{array}$

   (d) $\begin{array}{r} 255 \\ +\ \underline{\ 99} \end{array}$ (e) $\begin{array}{r} 288 \\ +\ \underline{548} \end{array}$ (f) $\begin{array}{r} 620 \\ +\ \underline{193} \end{array}$

7. What is the total of 28, 127 and 400?

8. (a) Add 256 and 17 and 312
   (b) Add 37, 169, 200 and 451

CONCEPT OF SUBTRACTION

Pre-skills
- Counting

Skills developed
- Understanding meaning of subtraction
- Use of subtraction symbol

In this session the concept of subtraction is looked at informally, using numbers up to 20.
The aim is to:
- establish the concept of **'take away'**
- introduce the subtraction **symbol**
- use the **languauge** of subtraction eg. *take away, remove, reduce, take off, decrease, minus, difference, subtract, from.*

Materials
- Dice
- Deck of playing cards
- Counters or blocks or beans (lima, kidney etc.)
- Set of numeral cards *
- Set of symbol cards *
  (* see *PREPARATION)*

PREPARATION

Numeral Cards

Using blank playing cards (or cut your own) write on them the numbers 0 to 20. Make several copies of each number.

0 9 13 7 etc.

Symbol Cards

Using the playing cards on their side, write the symbols '+', '-', 'x', '÷', =.
The number of duplicates needed will depend on the size of your group. (see Activity 3)

= + - X ÷

Materials
- Dice

SESSION OUTLINE

There are 4 activities, all encouraging verbal descriptions of subtraction.

Activity 1:

A short activity which focuses on the concept of **'take-away'**.

To achieve this, students draw upon their own ideas to tell stories about 'take away' situations in real life.
Working in a group, ask students in turn to roll 2 dice and tell a 'take-away' story using the two numbers. Start the ball rolling yourself.

eg. Throw say 6 and 3.
'Amed had 6 coins but there was a hole in his pocket and 3 fell out'.

Discreetly record the everyday words the students used for telling their 'take away' stories:

fell out, disappeared, going, loss, died, got smaller etc.

At the end of the activity discuss this list, and pin it up for future reference.

Activity 2:

This activity introduces the **subtraction symbol ' - '**.

Materials

- Counters or beans etc.

Working in a group, place a box of counters (blocks, matchsticks etc) on the table. Select a group of them and then remove some, saying

'9 counters take away 5 leaves 4'

Record this on the board as:

9 **take away** 5 **leaves** 4.

Ask the students in turn to do likewise and to describe what they are doing in terms of 'take away'.
Record on the board their examples :

12 **take away** 10 **leaves** 2

When all have had a turn, use the recordings on the board to relate the subtraction symbol '-' with the words **'take away'**, and to relate the word **'leaves'** with the equals symbol "="
Rewrite the subtraction on the board in symbols.

ie. the board will show:

9	**take away**	5	**leaves**	4
9	-	5	=	4
12	**take away**	10	**leaves**	2
12	-	10	=	2

Rub out the word sentences, leaving only the symbol sentences (9 - 5 = 4) and ask students to read them aloud.
eg. *'9 take away 5 leaves 4'*
or any other correct wording they think of.

Note: Your students may well use language other than "take away" when describing what they are doing (eg. *9 minus 5, 9 subtract 5).* This is fine. The important thing when recording on the board is the order of the 2 numbers. The larger number must appear first when using the ' - ' symbol.

Materials

- Set of numeral cards
- Set of symbol cards
- Counters or blocks or beans etc.

Activity 3:

This activity gives students practice in using the **subtraction symbol '-'**, and relating the operation to concrete examples. They are encouraged to use their own words to describe the process.

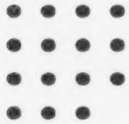
Working individually or in pairs, give each student or pair an ' = ' card and a ' - ' card. Deal each 2 numeral cards. Leave the rest of the cards face up on the table. Have a box of objects (counters, blocks, beans etc) available.

Ask the students to:

- *make a subtraction problem using the 4 given cards*

15 - 3 =

- *model it with the counters*



- *find among the remaining cards on the table the number to complete the problem*

15 - 3 = 12

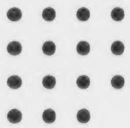
- *describe what you have done,*

eg. *'I started with 15 counters and then took away 3 of them and finished with 12'.*

During this activity, take note of the **subtraction language** used by students and record discreetly the different expressions used. Introduce some yourself if necessary. Possible expressions are: *take away, started with, take off, remove, reduce, minus, decrease.*

Discuss with students the variety of language used, noting which are strictly mathematical terms and which are everyday language. Compare with the list generated in *Activity 1.* Add any further contributions to the list. Keep this list for future reference when working on subtraction.

When students are describing the 'take away' process in their own words, focus them on expressing the larger number first. Sometimes students may be able to come up with the correct answer to a subtraction problem, but be confused about how it relates to the written record (15 - 3 = 12) and the concrete model.



Activity 4:
In this activity students model their own subtraction equations, record them in writing and have further practice in verbalising the process.

Materials:
- Counters or beans etc.

Give each student a pile of counters (less than 20). Ask them to model and then write down all the take away problems they can, starting each time with the given number of counters.
eg. given 5 counters

5 - 1 = 4 ● ● ● ● ●

5 - 2 = 3 ● ● ● ● ●

5 - 3 = 2 ● ● ● ● ●

5 - 4 = 1 ● ● ● ● ●

(and don't forget 5 - 5 = 0)

Ask students to read out their equations when finished.

eg. *'5 take away 1 leaves 4'*
'I had 5 counters and removed 2 which leaves 3' etc.

If appropriate, ask students to tell a story about each equation.

BUILDING SUBTRACTION SKILLS

Pre-skills
- *Concept of Subtraction*
- *Building Addition Skills*

Skills developed
- Formal method of subtraction for numbers less than 1,000

Materials
- Straws
- *'Operations Table'* (see *Building Addition Skills*)
- Worksheets 1, 2, 3, 4

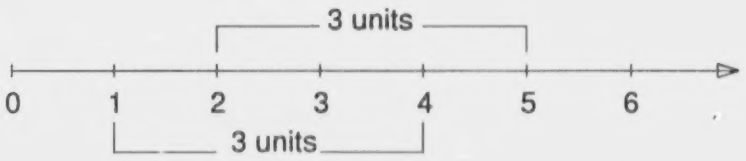
This session uses straws or MAB blocks (use whichever you are happy with) to develop the formal method of subtraction by columns.

Most probably two different methods of subtraction will be used by students in your group:
A. **decomposition** *('regrouping')*
B. **equal addition** *('borrowing & pay back')*

Method A is a direct abstraction from concrete experience, and is the method most commonly taught in schools today. **Method B** is a modification of method A and was the method taught in schools some years ago. So older students in your group are most likely to be familiar with this method. They may well be confused by their children who are learning method A!

eg. A. $$\begin{array}{r} \overset{4}{\cancel{5}}\,{}^{1}3 \\ -\underline{14} \\ 39 \end{array}$$ B. $$\begin{array}{r} 5\,{}^{1}3 \\ -\underline{{}^{1}1\,4} \\ 39 \end{array}$$

Method B employs the fact that (5-2) is equivalent to (4-1), ie. increasing the bottom 10's column by 1 in B gives the same result as decreasing the top 10's column by 1 in A. The difference in both cases is 3. This can be seen on the number line:



In this session we explain the method A, known as **regrouping**. We recommend this method as it is the method currently taught in schools today and it is the easiest to understand.

However, if your students have learnt the **'borrow and pay back'** method, and wish to understand its derivation, you can develop this from method A by using the explanation with the number line above.

SESSION OUTLINE

As with the session *'Building Addition Skills'* we illustrate examples using both straws and MAB blocks.

The order of the examples is:

1. tens and units, no regrouping eg. 35-24
2. tens and units, with regrouping eg. 32-14
3. hundreds, tens & units, with regrouping eg. 452-163

We have included in the text only one example of each type to illustrate the method. However, when working with your students, it will be necessary to demonstrate a number of examples. Following the three worked examples is a list of graded examples you can use for further practice.
As with *Building Addition Skills*, ask students to think of stories to go with each example and encourage a range of **'subtraction language'.**

eg. 35-24

At the end of the weekend 24 guests left the motel, which had been filled with 35 guests. How many stayed on?

Be aware of the two orders in which a subtraction problem can be expressed:

- 24 is subtracted from 35
- 35 minus 24

This change of order in presenting the numbers can cause confusion. Relating the problems to 'real-life' situations by story telling will help to minimize this.

The three worked examples below have the numerical steps written alongside each stage of the straw work. When demonstrating these examples to your students, start by using only straws and verbal description of the steps. Allow students plenty of practice at describing the operation out loud as they perform it, before moving on to the written representation of the steps.

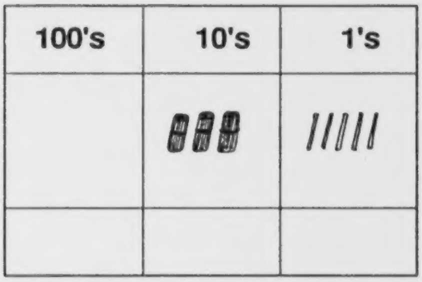
Example 1: (tens and units; no regrouping)

24 subtracted from 35

Language and story

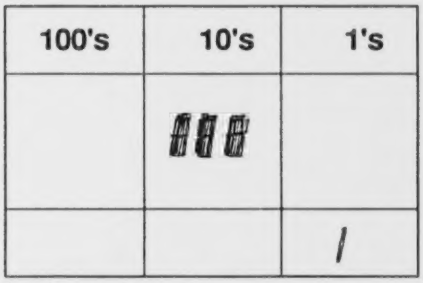
eg. *There were 35 guests at a motel. At the end of the weekend 24 guests left. How many stayed on?*

Using straws



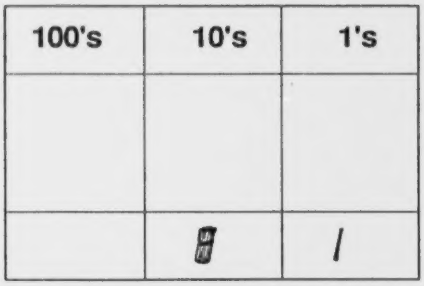
35

Represent the first number.



35
-24
1

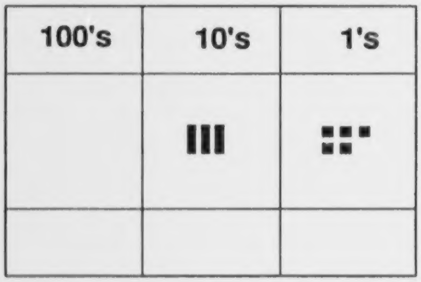
In the units column remove 4 straws. Bring the remaining straws in the unit column below the 'answer line'.

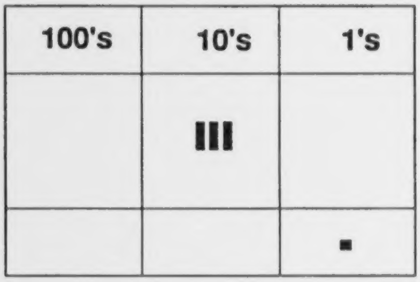


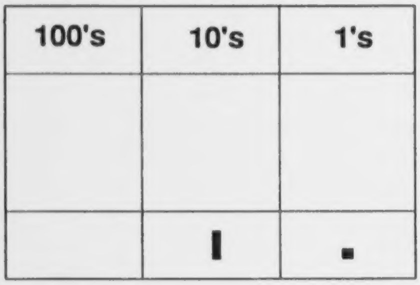
35
-24
11

In the tens column remove two bundles of straws. Bring the remaining straws in the tens column below the answer line. Read off the new number that results ie. 11.

Using MAB







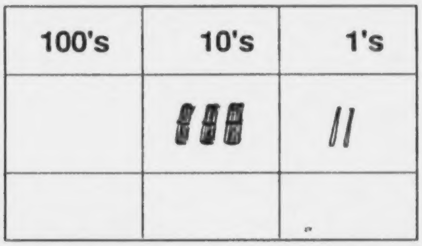
Example 2: (tens and units; with regrouping)

14 subtracted from 32

Language and story

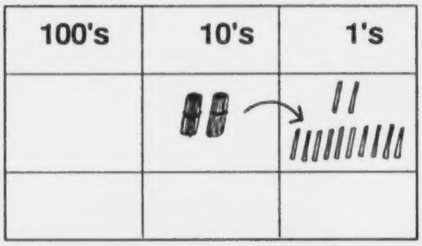
eg. *The train leaves in 32 minutes and it takes 14 minutes to walk to the station. How many minutes will I have to wait at the station?*

Using straws



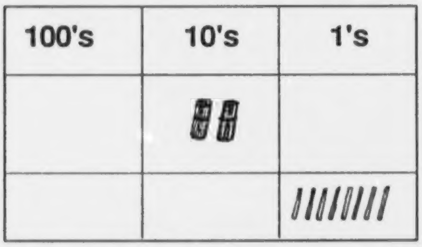
32

Represent the first number.



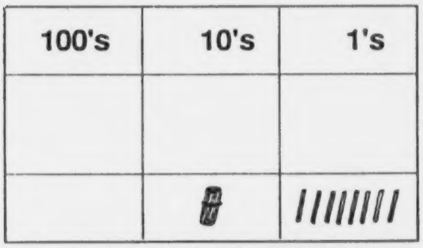
$$\begin{array}{r} {}^{2}\cancel{3}{}^{1}2 \\ -\ 14 \\ \hline \\ \hline \end{array}$$

In the units column, we wish to remove 4 straws. It can't be done, so take one bundle of straws from the tens column, unbundle it and place in units column.



$$\begin{array}{r} {}^{2}\cancel{3}{}^{1}2 \\ -\ 14 \\ \hline 8 \\ \hline \end{array}$$

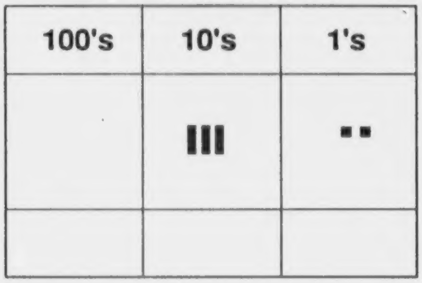
Now remove 4 straws from the units column and bring the remaining 8 straws below the answer line.

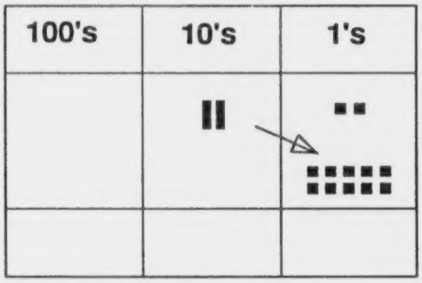


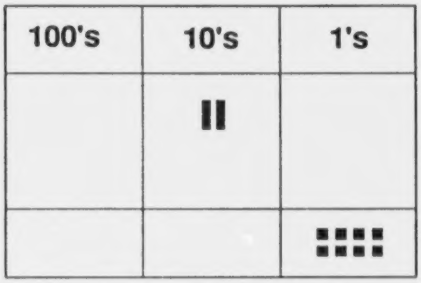
$$\begin{array}{r} {}^{2}\cancel{3}{}^{1}2 \\ -\ 14 \\ \hline 18 \\ \hline \end{array}$$

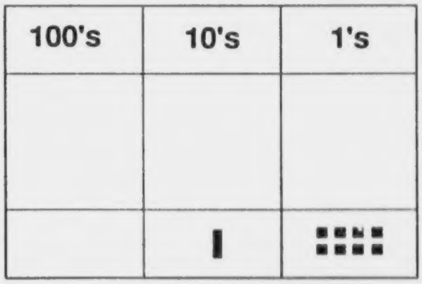
Remove one bundle of straws from the tens column and bring the remaining one bundle below the answer line. Read off the new number that results ie. 18.

Using MAB









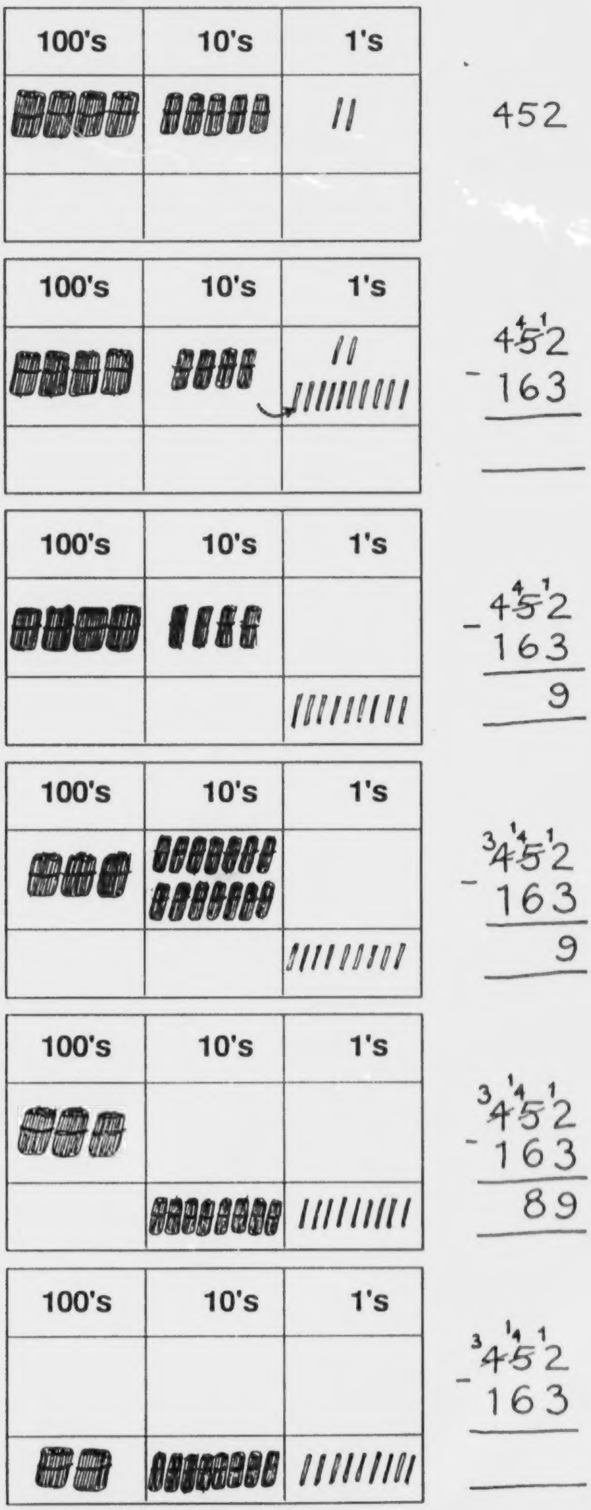
Example 3: (tens and units; with regrouping)

163 subtracted from 452

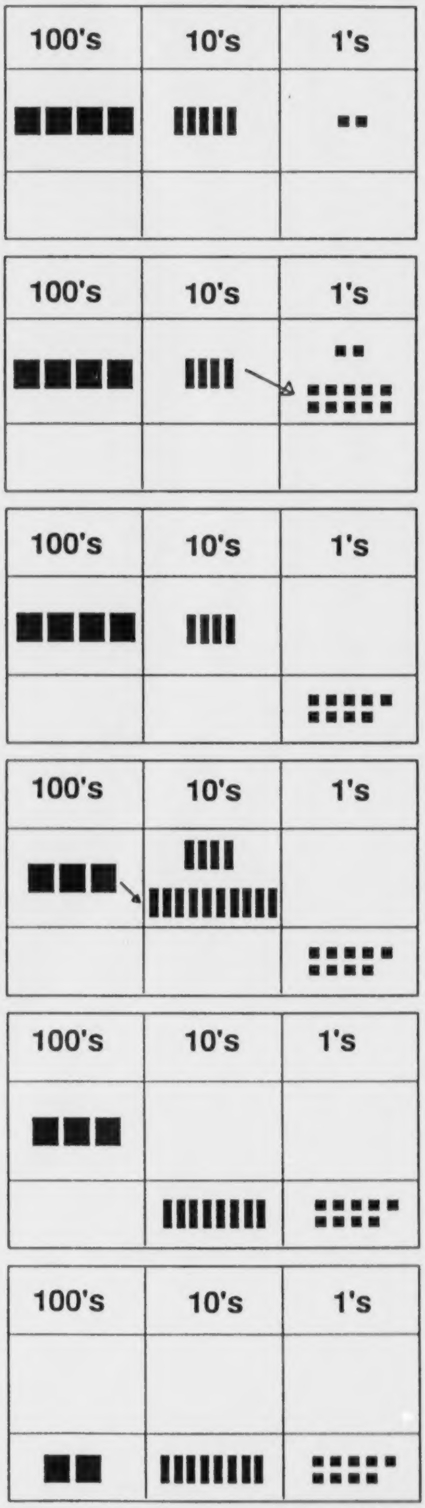
Language and story

eg. *A small village had a population of 452. 163 were children. How many were adults?*

Using straws


100's
10's
1's
452
4 5 2
- 163
9
89
3 4 5 2

Using MAB



Below are some more graded examples your students can solve using the straws:

I tens and units, no regrouping

1. 46 - 23
2. 39 - 15
3. 64 - 52
4. 78 - 50

II tens and units, with regrouping

1. 32 - 18
2. 55 - 37
3. 80 - 39
4. 41 - 23

Now students can do **Worksheet 1 and 2.** Make sure that all students can demonstrate the use of straws or MAB blocks to solve the problems. Some students may need much longer with concrete materials and should be encouraged to use them as long as needed.

III hundreds, tens and units, with regrouping

1. 254 - 137
2. 312 - 148
3. 525 - 239
4. 401 - 162

Students can now do **Worksheets 3 and 4.**

BUILDING SUBTRACTION SKILLS Worksheet 1

1. Do the following subtractions:

(a)	45 - 12	(d)	86 - 30	(g)	52 - 31
(b)	29 - 18	(e)	37 - 26	(h)	68 - 43
(c)	76 - 45	(f)	90 - 40	(i)	19 - 7

2. Find (a) 86 minus 24
(b) 37 minus 14
(c) 61 minus 40
(d) 97 minus 73
(e) 59 minus 47

3. Take 23 away from 88

4. What is 56 less than 97?

5. Do the following take away problems:

(a) 36 - 17
(b) 42 - 25
(c) 60 - 38
(d) 78 - 59
(e) 57 - 17
(f) 90 - 77
(g) 83 - 25
(h) 49 - 28
(i) 24 - 15
(j) 67 - 28

BUILDING SUBTRACTION SKILLS Worksheet 2

1. How much greater is 57 than 26?

2. By how much is 83 bigger than 31?

3. What is the difference between the following pairs of numbers.?

   (a) 27 and 16
   (b) 85 and 29
   (c) 31 and 76
   (d) 52 and 81
   (e) 60 and 39
   (f) 43 and 87
   (g) 13 and 62
   (h) 74 and 92
   (i) 78 and 33
   (j) 29 and 80

4. Arrange the following numbers in order from smallest to largest.

   78, 53, 92, 23, 32, 15, 65, 42

   Find the increase between **consecutive** numbers, ie. numbers that follow each other.

5. Arrange the following numbers in descending order.

   34, 61, 7, 97, 16

   Find the decrease between **consecutive** numbers.

6. What would you add to 27 to make 56?

7. What is 83 less 18?

8. What is 15 less than 43?

BUILDING SUBTRACTION SKILLS Worksheet 3

1. Subtract 153 from 289.
2. What is 604 less than 967?
3. Find the difference between 214 and 568.
4. Take 450 away from 788.
5. Do the following subtractions:

(a) 267 -132	(b) 350 -127	(c) 456 -343
(d) 432 -210	(e) 617 -243	(f) 309 -156
(g) 862 -345	(h) 523 -315	(i) 963 -591

BUILDING SUBTRACTION SKILLS Worksheet 4

1. What is the difference between the following pairs of numbers?

   (a) 582 and 27
   (b) 600 and 438
   (c) 754 and 827
   (d) 86 and 522
   (e) 209 and 75
   (f) 311 and 400
   (g) 523 and 174
   (h) 289 and 947

2. Arrange the following numbers in ascending order, and find the increase from one number to the next:

   237, 85, 118, 468, 380, 162, 303

3. How much greater is 789 than 599?

4. What would you add to 156 to get 650?

5. What is 400 less 237?

SUBTRACTION IN STAGES

Skills developed

- Subtraction done mentally

Using this method students can learn to do a subtraction in their head by separating it into two steps.
The usual written method is not the easiest way to do subtraction mentally and students might find this approach helpful.

SESSION OUTLINE

Go through these two examples together.

Example 1:

I have $60 and pay $24 for a bill. How much is left?

First take off 20 60 - 20 = 40
Next take off 4 40 - 4 = 36

or First take off 4 60 - 4 = 56
Next take off 20 56 - 20 = 36

It is easier to work with the tens column first, and then the units column.

Example 2: Working out change

$7 - $5.30

First step... $7 - $5 = $2
Next step... $2 - 30c= $1.70

After looking at the examples above give the group some practice using the figures below. Write the subtractions on the board or on cards and ask the students to work them out in their head and just give the answer.
If they have trouble, encourage them to say each step as they do it but try **not** putting any steps on paper.

Say or write the answer, do not write down the question.

$70 - $38
$50 - $18
$80 - $65

$90 - $48
$120 - $84
$100 - $79

$10 - $8.30
$10 - $4.80
$10 - $5.20

$10 - $3.60
$10 - $6.10
$10 - $4.60

$5 - $3.20
$8 - $5.80
$9 - $6.50

$1 - 65c
$1 - 25c
$1 - 45c

Notes: *Section 5, Decimals: Metric and Money,* has other methods and more examples of money problems.

ADDITION AND SUBTRACTION - WORD PROBLEMS

Skills developed

- Recognition of addition or subtraction in a problem

Materials

- Worksheets 1to 4

This session provides some word problems which use addition and subtraction language in everyday situations. It is no use learning the mechanical skills of addition and subtraction if students cannot choose the appropriate situations in which to use them. The many worksheets supplied will give ample practice.

SESSION OUTLINE

Although we have kept the language simple, you may need to judge the reading level your students can cope with. If it is too difficult, you or another student could read out the problem. Students will have different requirements and interests and you may want to make up appropriate worksheets, using these ideas, but adapting them to another topic.

These problems can be used in a variety of ways:

- Presented one at a time, writing them on the board or a card. You can then choose the order.
- A whole worksheet is given.

Either way, problems should be discussed before attempting to find the answers.

eg. *Will you add or subtract?*
What answer would you expect?

This could be done in pairs or as a group.

Note : Most useful calculations done by adults are done mentally. Setting out the problem is not as important as understanding which operation should be used in the solution.

Worksheet 1

These are simple problems. They focus on the language of addition and subtraction.

Worksheets 2 to 9

These are more difficult. When discussing the problems at the start, ask questions like:

- *What is happening?*
- *Are two numbers being gathered together?* (adding)
- *Is part of the number being taken away?* (subtracting)
- *Are you finding the difference between two numbers?* (subtracting)

Hopefully, some of these problems will generate discussion and stimulate students to seek more information, even commenting on the accuracy of these figures. The newspaper is a good source for these types of figures.

Worksheet 10

This has magic squares. You may need to explain these: every row, column and diagonal should add to the total given.

Extension:

Ask the students to make up some problems using situations from their own lives.

Further resources:

- Watson T.F., Quinn T.A., Aitken J.
  Ten at a Time Books 1-4, Martin Educational 1986

- Barry, Bill and Widders, Peter
  HBJ Fundamentals Books 3 and 4
  Harcourt Brace Jovanovich 1989.

ADDITION & SUBTRACTION Worksheet 1

1. 3 more than 7 is ....

2. 6 less than 30 is........................

3. 31 and 9 is.................................

4. take 6 from 50...........................

5. 60 plus 40 is..............................

6. the total of 33 and 7 is.........................

7. 100 minus 5 is..........................

8. subtract 8 from 20..............................

9. 53 added to 7 makes.........................

10. 100 is 94 and............................

ADDITION & SUBTRACTION Worksheet 2

1. Susie has $1.30 and finds another 70c.
   How much does she have now?

2. At 10.15am Anna has a 10 minute teabreak.
   What time does she start work again?

3. Melda has $5 to buy a $1.50 ticket.
   How much change does she get?

4. It takes Ho 20 minutes to walk to work. He must be there at 8.45.
   What time should he leave home?

5. A club hires two buses for its outing.
   36 people get on the blue bus, 45 on the red.
   How many people altogether?

ADDITION & SUBTRACTION Worksheet 3

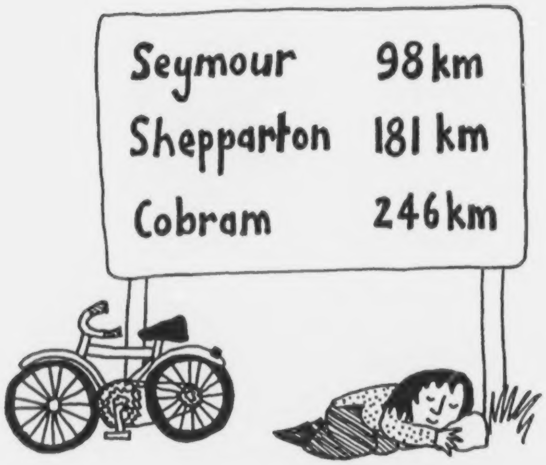
1. There are 20 places in a First-aid class.
   7 people have enrolled.
   How many places are left?

2. Bendigo is 160km from Maria's house.
   She stops for coffee after 85km.
   How much further must she drive?

3. Judith's alarm goes off at 6.45am.
   She takes twelve minutes to get herself out of bed.
   What time does she get up?

4. A cake recipe needs 500grams of flour.
   Jim has only 350grams.
   How much must he borrow from his neighbour?

5.



How far between Shepparton and Cobram?

ADDITION & SUBTRACTION

Worksheet 4

1. How old will you be in the year 2000?

2. The first train from Melbourne to Sydney ran on 21st August 1883.
How many years ago was this?

3. A mother is 50 years old and her son is 16.
How old was she when her son was born?

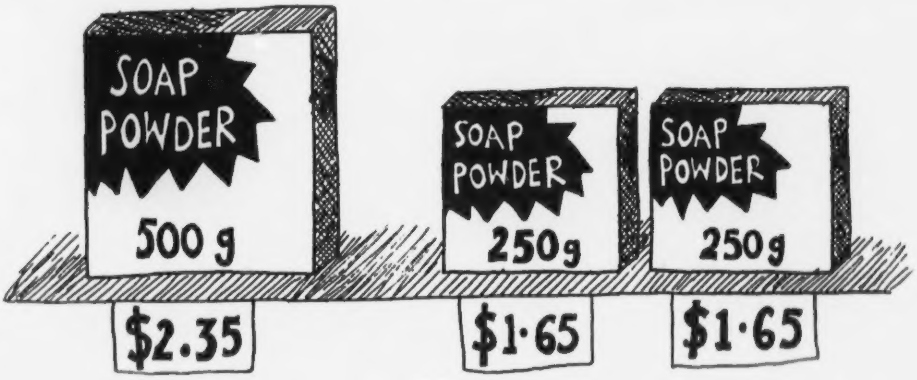
4. One boiled potato has 335 kilojoules.
If it is made into chips it has 1008 kilojoules.
How many more kilojoules in chips?

5. The bus comes every 25 minutes.
I missed the 2.16pm bus.
When will the next bus come?

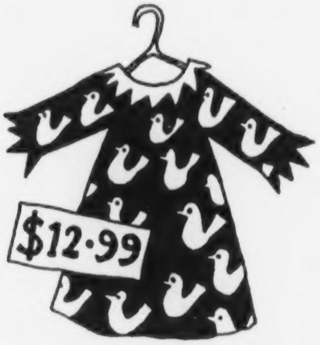
ADDITION & SUBTRACTION Worksheet 5

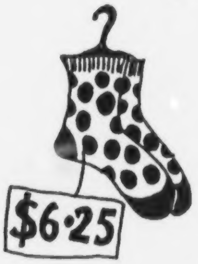
1. The distance from Sydney to Melbourne is 883km by the Hume Highway, or 1048km by the Princes Highway.
   Which is the longer trip?
   By how much?

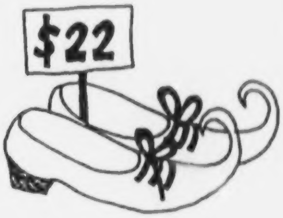
2. Is it cheaper to buy one large packet or two small packets?
   How much would you save?


SOAP POWDER
500 g
$2.35
SOAP POWDER
250g
$1·65
SOAP POWDER
250g
$1·65

3. I have $45 in my purse. Is it enough to buy:







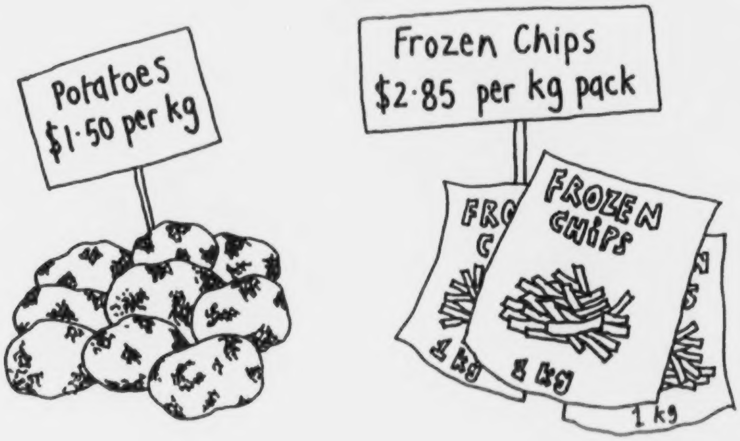
Can I also afford a cup of coffee?

ADDITION & SUBTRACTION Worksheet 6

1. How many hours of sleep did you have last night?

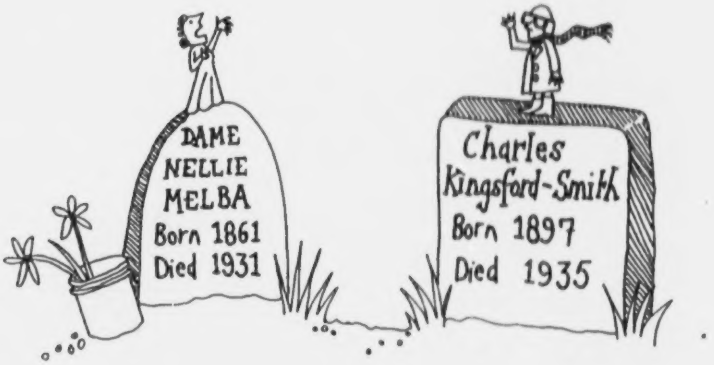
2. The plane will be 2 and a half hours late.
   It should have come at 8.35am.
   When will it arrive?

3.


Potatoes
$1·50 per kg
Frozen Chips
$2·85 per kg pack
FROZEN CHIPS
FRO C
1 kg
1 kg
1 kg

How much more does it cost to buy frozen chips than make your own?

4.

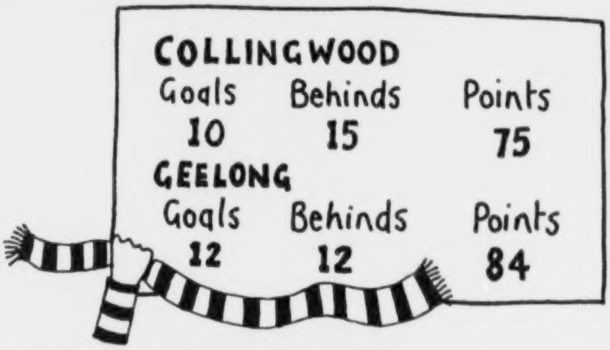

DAME
NELLIE
MELBA
Born 1861
Died 1931
Charles
Kingsford-Smith
Born 1897
Died 1935

How old were these people when they died?

5. I paid the phone bill of \$45.16 and electricity bill of \$69.24.
   How much would I have left from \$150?

ADDITION & SUBTRACTION   Worksheet 7

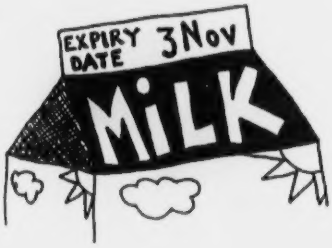
1.


COLLINGWOOD
Goals Behinds Points
10 15 75
GEELONG
Goals Behinds Points
12 12 84

How many points is Geelong leading by?

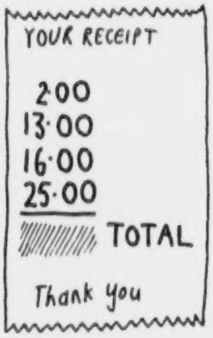
2. A typical family of 4 with dishwasher and washing machine use 250,000 litres of water inside the house each year.
They use 60,000 litres outside.
How much is this altogether?
If they get a large pool they will need 50,000 litres to fill it.
How much will they use now?

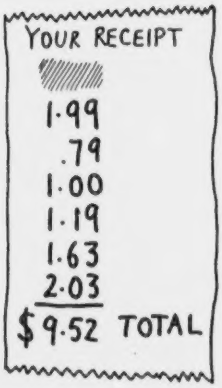
3. Today is 27th October


EXPIRY DATE 3Nov
MiLK

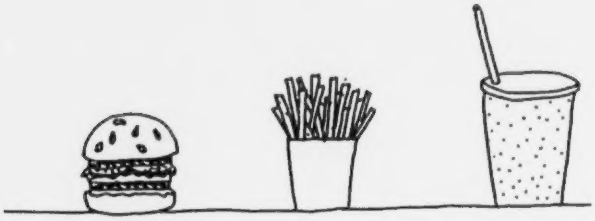
Is it still safe to drink this one week later?

4. What is the missing amount?


YOUR RECEIPT
2·00
13·00
16·00
25·00
TOTAL
Thank you


YOUR RECEIPT
1·99
.79
1·00
1·19
1.63
2·03
$9·52 TOTAL

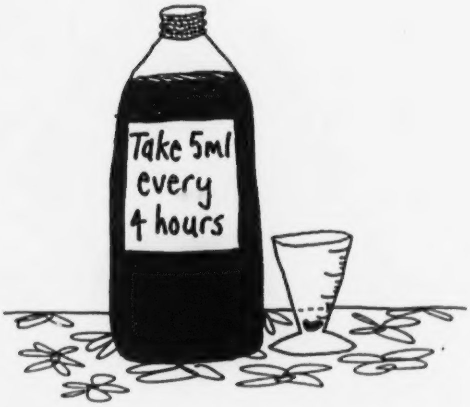
1.



	kilojoules
Hamburger	2311
French fries	1612
Chocolate milkshake	1625
	____

This is half the number of kilojoules needed for a day.
How much is the daily amount?

2.



First dose at 11.30 a.m.
When should I take the next 3 doses?

3. Where has my money gone today?
I had $30 in my purse this morning.
I spent $1.20 on a cup of coffee, 70c on a chocolate bar, $2.30 on lunch, $2.50 on fares, $1.50 on a magazine.
How much do I have left?

1. In 1788 there were 13,000 Kooris (aboriginal people) in Victoria.
   In 1886 there were 806.

   How many more were there in 1788?
   How many years did it take for this change?

2. Between 1947 and 1954, 170,000 people migrated from Europe to Australia.
   282,000 went to U.S.A.
   How many more went to USA?

3. Smoking one packet of cigarettes each day takes about 7 years off your life expectancy.
   Non-smokers can expect to live about 74 years.
   How long will a smoker (one packet a day) expect to live?

4. The Murray River is 2589km long.
   The Darling River is 2735km long.

   Which river is longer?
   How much longer is it?

ADDITION & SUBTRACTION Worksheet 10

Fill in these magic squares.

1.

70c	$2.10	
	30c	$1.70

Total $3.60

2.

5 days		10 days
	1 week	

Total 3 weeks

3.

	10	3
9		7

Total 18

4.

		7
	10	
		16

Total 30

5.

$1.50		
$2.30		$1.90
		$2.70

Total $6.30

6.

	1 hour	
30 min.	75 mins.	

Total 3 hours

ADDITION & SUBTRACTION Answers

BUILDING ADDITION SKILLS WORKSHEET 1

1. (a) 37 (b) 95 (c) 57
2. (a) 65 (b) 73 (c) 93
3. (a) 39 (b) 97
4. 41
5. (a) 44 (b) 80
6. (a) 90 (b) 77
7. 91
8. 91

BUILDING ADDITION SKILLS WORKSHEET 2

1. 463
2. (a) 578 (b) 397 (c) 870
3. 497
4. (a) 445 (b) 481 (c) 201 (d) 633 (e) 720
5. 391
6. (a) 513 (b) 489 (c) 862 (d) 354 (e) 836
   (f) 813
7. 555
8. (a) 585 (b) 857

BUILDING SUBTRACTION SKILLS WORKSHEET 1

1. (a) 33 (b) 11 (c) 31 (d) 56 (e) 11
   (f) 50 (g) 21 (h) 25 (h) 12
2. (a) 62 (b) 23 (c) 21 (d) 24 (e) 12
3. 65
4. 41
5. (a) 19 (b) 17 (c) 22 (d) 19 (e) 40
   (f) 13 (g) 58 (h) 21 (i) 9 (j) 39

ADDITION & SUBTRACTION Answers

BUILDING SUBTRACTION SKILLS WORKSHEET 2

1. 31
2. 52
3. (a) 11 (b) 56 (c) 45 (d) 29 (e) 21
   (f) 44 (g) 49 (h) 18 (i) 45 (j) 51
4. 15, 23, 32, 42, 53, 65, 78, 92
   increases: 8, 9, 10, 11, 12, 13, 14
5. 97, 61, 34, 16, 7
   decreases: 36, 27, 18, 9
6. 29
7. 65
8. 28

BUILDING SUBTRACTION SKILLS WORKSHEET 3

1. 136
2. 363
3. 354
4. 338
5. (a) 135 (b) 223 (c) 113 (d) 222 (e) 374
   (f) 153 (g) 517 (h) 208 (i) 372

BUILDING SUBTRACTION SKILLS WORKSHEET 4

1. (a) 555 (b) 162 (c) 73 (d) 436 (e) 134
   (f) 89 (g) 349 (h) 658
2. 85, 118, 162, 237, 303, 380, 468
   increases: 33, 44, 75, 66
3. 190
4. 494
5. 163

ADDITION & SUBTRACTION Answers

WORD PROBLEMS WORKSHEET 1

1. 10 2. 24 3. 40 4. 44 5. 100
6. 40 7. 95 8. 12 9. 60 10. 6

WORD PROBLEMS WORKSHEET 2

1. $2.00 2. 10.25 am 3. $3.50
4. 8.25 am 5. 81

WORD PROBLEMS WORKSHEET 3

1. 13 2. 75 km 3. 6.57 am
4. 150g. 5. 65 km

WORD PROBLEMS WORKSHEET 4

1. Depends on your age
2. Depends on the year. 107 years from 1990.
3. 34
4. 673 kilojoules
5. 2.41 pm

WORD PROBLEMS WORKSHEET 5

1. The Princes Highway by 165 km
2. One large packet is 95c cheaper
3. Yes ($41.24)

WORD PROBLEMS WORKSHEET 6

1. Individual answers
2. 11.05 am
3. $1.35
4. 70 years, 38 years
5. $35.60

WORD PROBLEMS WORKSHEET 7

1. 9 points 2. 310,000L; 360,000L 3. Yes
4. $56.00; 89 cents

WORD PROBLEMS WORKSHEET 8

1. 11096 kilojoules 2. 3.30 pm; 7.30 pm; 11.30 pm
3. $21.80

WORD PROBLEMS WORKSHEET 9

1. 12,194 more; 98 years.
2. 112,000 more 3. 67 years
4. The Darling River; 146 km longer

WORD PROBLEMS WORKSHEET 9

1.

		80c
$1.30	$1.20	$1.10
$1.60		

2.

	6 days	
2 weeks		0
2 days	8 days	11 days

3.

5		
4	6	8
	2	

4.

4	19	
13		7
13	1	

5.

	$3.10	$1.70
	$2.10	
$2.50	$1.10	

6.

45min	45min	90min
105min		15min
		75min

▸ MULTIPLICATION AND DIVISION ◂

MULTIPLICATION AND DIVISION
Introductory Notes

This section addresses many important aspects of multiplication and division. As with addition and subtraction it is vital that students:

- gain an understanding of the meaning and symbolic representation of the operations
- appreciate **when** the operations should be used and the **language** associated with them
- have plenty of practice in using the operations
- gain familiarity with some short-cut methods.

These aspects are covered in the following sessions:

Populations are Multiplying provides an opportunity to observe students' multiplication skills while using pictographs of populations of Australia and nearby Asian countries.

The Concept of Multiplication is concerned with the meaning of multiplication, the language and some physical representations.

Building Multiplication Skills uses hands on materials to teach multiplication methods.

Learning Multiplication Tables provides a variety of ideas for assisting students to learn multiplication tables.

Some Short Cuts in Multiplication deals with multiplication by 10, 100, 1000 etc.

Doubling looks at some alternative methods of multiplication which can be done mentally.

Concept of Division examines real life situations in which division is used, models these using hands-on materials and explores the associated language and symbols.

Building Division Skills uses hands-on material to develop a formal method of division.

Word Problems: Multiplication and Division provides a selection of worksheets containing short problems which put multiplication and division into everyday contexts. These are ideal for indivdiual student work.

Phone Calls is a group acitivity using multiplication and division for problem solving activities associated with telephone charges.

Before commencing multiplication and division with your students, read and consider the following notes on multiplication tables and division.

MULTIPLICATION TABLES: To Learn or not to Learn

The argument about whether students should or should not learn tables is an ongoing one which can lead to heated debate. It is possible to survive your everyday life without knowing tables. However students will be more mathematically competent and feel much more confident if they can at least remember the basic multiplication table facts up to 10 by 10.

The task of learning their tables may not really be as great as students imagine. Many of them already remember the simpler tables such as five, ten and two, and in fact only have a few trouble spots in others. (This is further discussed in the session *Learning Multiplication Tables).* Once you let students know that you can give them new strategies to help them memorise tables, and that it can be done gradually over the duration of the course, they may be more motivated to have another go.

In any case, the lack of memory of tables should not stop students participating in other sessions on concepts such as *The Concept of Multiplication, Short Cuts in Multiplication* and *Doubling,* or multiplication used in particular contexts as in *Populations are Multiplying, Phone Calls* or *Word Problems: Multiplication and Division.*

DIVISION

Division is often a trouble spot. Therefore, in the sessions that follow, we spend a little time establishing the everyday concept of division as "equal sharing out" before going on to establish the formal method of division.

Some of the points to be considered:

There are 2 concepts of division

1. "Sharing out"

   eg. *a group of 7 people together win a raffle of $260.*
   How much money will each person get after the
   winnings are shared out?

2. "Lots of"

eg. *How many half-dozen egg cartons can be filled from 60 eggs?* (ie. lots of 6)

The first type of problem is the more common in real-life, hence the problems presented in the session, *Concept of Division* are all expressed in terms of "sharing out". We recommend that at this stage *only* a "sharing out" approach to division is taken to avoid confusion. In the later session *Word Problems* which looks at the links between division and multiplication, the "lots of" concept of division is covered.

Remainders

Remainders of "real-life" division problems are best handled according to their context.

LOTTERY TICKET

eg. 1. *9 sandwiches shared between 2 hungry people.*
Both people want their share, so the left over sandwich is neatly cut into halves and then each has 4 and a half sandwiches.
ie. **the remainder is expressed as a fraction.**

2. *5 people win $57 between them.*
After each person has received $11 each, $2 are left over. These $'s can be converted to cents and then shared. Each person will receive $11.40.
ie. **the remainder is expressed in decimal form.**

3. *3 friends pick apples together and have 28 in their basket when they finish.*
After sharing out the apples, each person would receive 9 apples and there would be one left over.
It would not be reasonable to try and chop the remaining apple into thirds.
ie. **the remainder is expressed as a "left over".**

Encourage discussion amongst your students of the most appropriate way to handle remainders.

The language of division

As with the other mathematical operations of addition, subtraction and multiplication, there is a variety of language associated with the concept of division. The problems presented are expressed in a variety of ways. Encourage your students to describe what they are doing when they are solving the problems, use as many different expressions as you can, and keep a list for student reference of the different terms that arise.

Remember to emphasise that the concept of division is an *equal* sharing.

Some expressions that arise in a division context are:

- *divided out*
- *shared*
- *chopped up*
- *distributed*
- *dealt out*
- *equal portions*

Order of the numbers

Confusion sometimes arises in the written expression of a division problem, eg. 35 ÷ 5, about which number represents what. By encouraging your students to *describe verbally* what they are doing when working on problems, and later to read aloud expressions such as 35 ÷ 5 = 7,

ie. *35 divided by 5 gives 7*
or
35 shared out amongst 5 people gives each person 7

this confusion can be avoided or minimised.

POPULATIONS ARE MULTIPLYING

Preskills

- Count in 20s

Skills Developed

- The meaning of multiplication
- Understanding pictographs

Materials

- Atlas
- Calculators (optional)
- Worksheet

This session can be used at a number of levels depending on the students' current skills. Multiplication is applied to a pictograph and this could be used as an introductory session to multiplication, or at a later stage as an application of multiplication.

The context gives students an opportunity to expand their knowledge of Australia in relation to neighbouring Asian countries.

SESSION OUTLINE

Preliminary Discussion

Give the students each a Worksheet and have a short discussion about the countries listed:-

- *Has anyone been to these countries?*
- *What do you know about them?*
- *Is there anything you particularly associate with them? (Food, dress, etc)*
- *Can you find them on the atlas?*

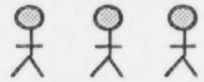
Find the countries in the atlas and comment on the relative amount of land (ie. size) of the other countries compared with Australia.

Population of Each Country

Working in a group or in pairs, direct students back to the Worksheet and concentrate on the population sizes with questions like:

- *Which has the most people?*
- *Which has the lowest population?*
- *Can you write them down in order of size?*
- *Can you work out the population of each using the pictographs?*

Express the populations in millions

eg.  means 60 million

If necessary, calculators can be used for this calculation.

After they have worked out the populations, go over their words and methods.

Possible responses for a population of eg. 80 million, would be:

Count in twenties to find the total ie. 20, 40, 60, 80 million.
There are 4 twenty millions.
Four lots of 20 million.
The population is 4 times 20 million.
Add 20 and 20 and 20 and 20 million.
Using the calculator it is 4 x 20 = or 20 x 4 =

Comparisons with Australia

Note Australia has a population of about 16 million, which has been rounded to 20 million in this pictograph.

Use the following questions to generate a discussion on Australia's population:

- *How many times bigger are these countries compared to Australia?*
- *Was the pictograph a useful method to show this?*
- *Why not use just population figures?*

Some possible responses are:

- *A pictograph is easier to read because a visual image is easier to take in than figures on a page.*
- *Comparisons are more obvious and you can see how many times bigger one country is than another.*

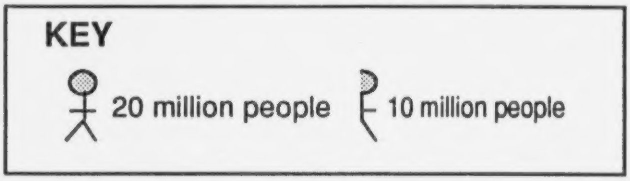
Note Below are actual population figures for your reference.

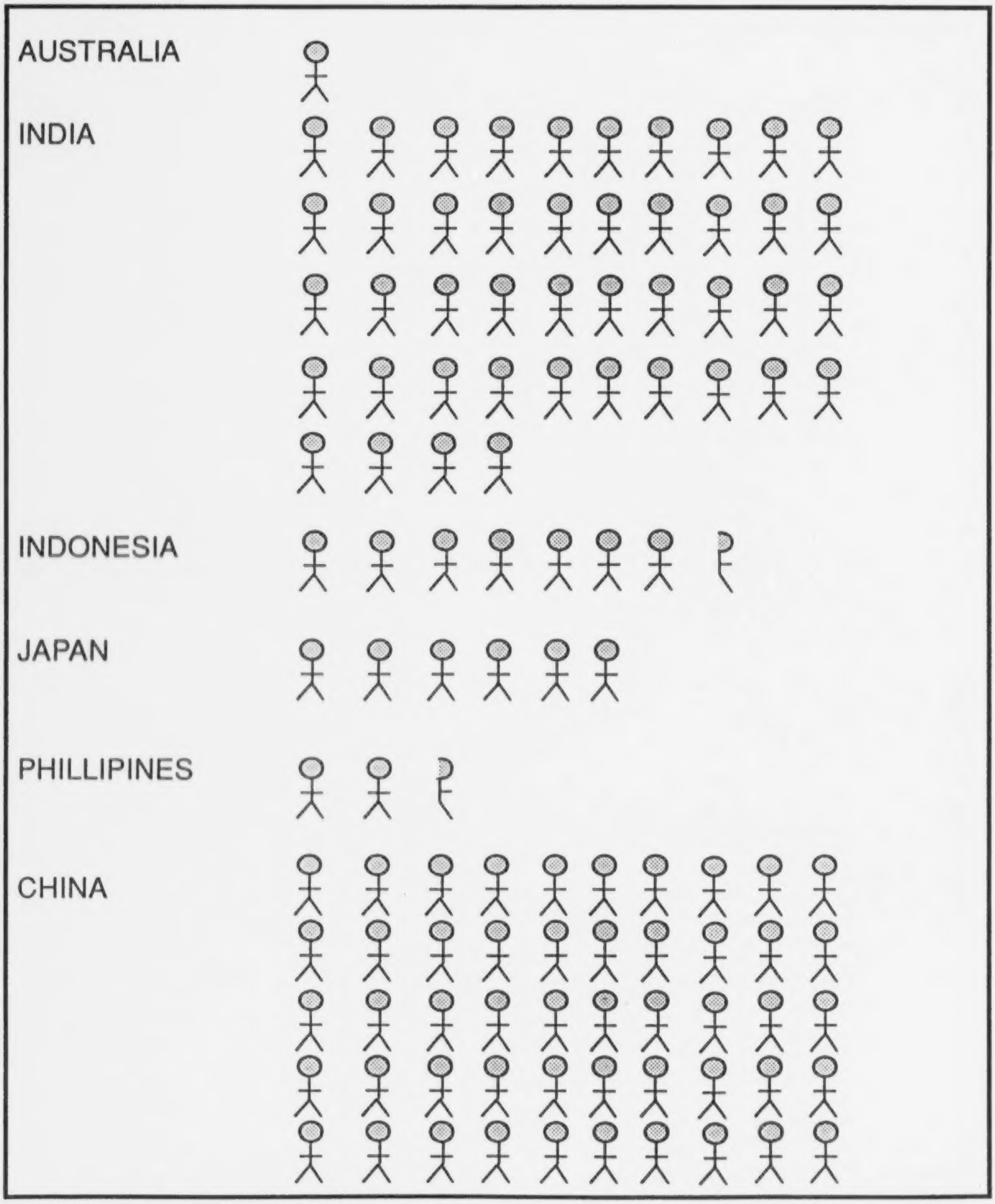
	Year	Population
Indonesia	1981	147,490,298
Australia	1986	15,602,156
Phillipines	1981	48,098,460
Japan	1985	121,047,196
India	1989	about 880 million

(Latest figures from Australian Bureau of Statistics March 1990)

POPULATIONS ARE MULTIPLYING Worksheet 1

POPULATIONS


KEY
20 million people
10 million people



CONCEPT OF MULTIPLICATION

Skills Developed

- Using the language of multiplication
- Concrete illustration of multiplication

Materials

- Worksheets 1 and 2
- Counters
- Cardboard to make strips (optional)

This session can be used in conjunction with, or instead of, *'Populations are Multiplying'* to:

- understand what multiplication is;
- use the language associated with multiplication;
- make a physical representation of what is happening.

SESSION OUTLINE

Below are 4 situations involving multiplication. Discuss these with your students as a group.

Example 1

Large tins of oil are on special in a shop. Five customers come in and each want two tins. How many should the storeman bring in?

Ask for as many ways of expressing this as possible, for example,

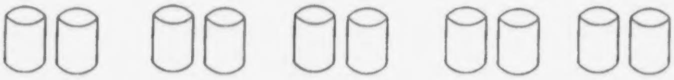
five lots of two tins
five twos
two tins five times

How could you write it in mathematical symbols?

5 x 2
2 + 2 + 2 + 2 + 2
2 x 5

Ask the students to show this with counters, or draw a picture.

eg.

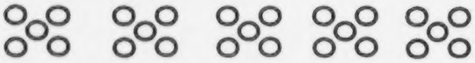


Example 2

A pair of rabbits usually has 5 babies in each litter. They had 5 litters last year. How many babies did the pair have at the end of the year?

Again go through the language, represent with drawings or counters, and mathematical symbols.

ie. five times five babies
five lots of five babies



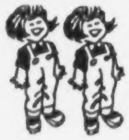
(counters)

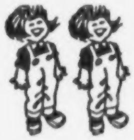
5 + 5 + 5 + 5 + 5
5 x 5

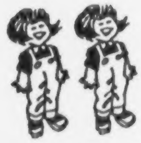
Example 3: **Multiplying by 1, multiplying by 0**

In a group of men:
3 men had 2 children each
2 men had 1 child each
4 men had no children
How many children in each case?

3 lots of 2 children:

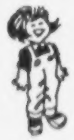


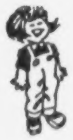




ie. 3 x 2 = 6

2 lots of 1 child:



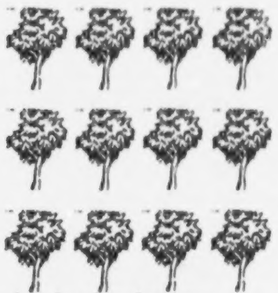


2 x 1 = 2

4 lots of 0 children: 4 x 0 = 0

Example 4: **Order of multiplication is reversible**

How many trees in this orchard?



This can be looked at as
4 rows of 3 (ie. 4 x 3) OR 3 rows of 4 (ie. 3 x 4)

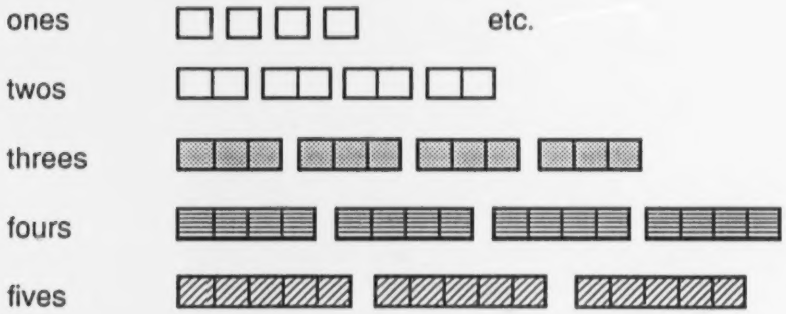
Note One or two students may feel happier doing repeated addition rather than multiplication. This is quite acceptable if they are comfortable doing that.

Now do **Worksheet 1.** Preferably go through it as a group or in small groups to encourage discussion. This Worksheet puts multiplication in context.

Worksheet 2 involves the reversible nature of multiplication.

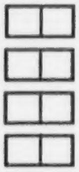
Cardboard Strips to Illustrate Multiplication

Make up a number of cardboard strips, each length a different colour

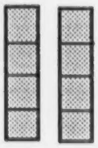


Use these to illustrate multiplication instead of counters

eg. 4 lots of 2



which is the same as 2 lots of 4



Demonstrate this by putting 2 x 4 on top of 4 x 2

MULTIPLICATION Worksheet 1

Use counters or drawings to show these multiplications. Write out the multiplication.

1. Each time I open the door 3 flies come in.
   How many flies come in after opening the door ten times?

2. Les spends $5 on each visit to the corner shop.
   How much does he spend in a week, if he goes 6 times?

3. Angela walks 5km from her home to the station each morning of a 5 day working week.
   How far does she walk in the mornings each week?

4. Angela's fares are $3 each day.
   How much does it cost her for a 5 day working week?

5. A swimming pool charges $2 entry.
   How much does it cost for 3 swims a week?

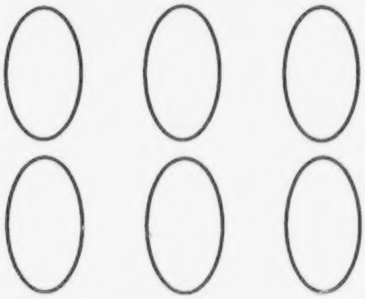
6. Sheila's phone rings 5 times one evening. Each call takes about 10 minutes.
   How long does Sheila spend on the phone?

7. On a holiday Peter budgeted $20 for each day.
   How much would he budget for a 5 day holiday?

MULTIPLICATION

Worksheet 2

Write two multiplications for each.



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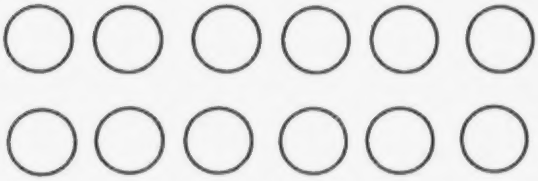
................X..............=................



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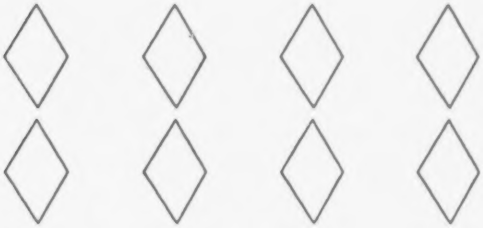

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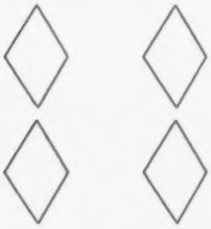

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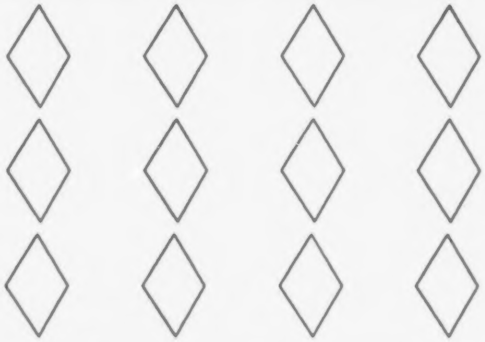

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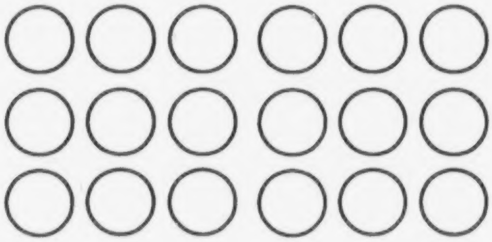
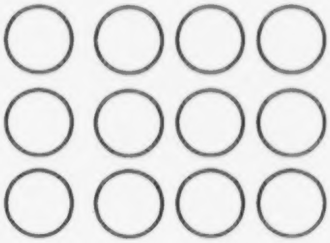


................X..............=................

................X..............=................



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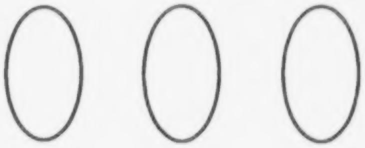

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BUILDING MULTIPLICATION SKILLS

Pre-skills
- *Populations are Multiplying*
- *Concept of Multiplication*

Skills developed
- Short multiplication

Materials
- Drinking straws cut in half (see session on addition)
- "Operations table" (see session on addition)
- Worksheet 1

In this session, the method for short multiplication is developed using hands on materials.

SESSION OUTLINE

Below are 3 worked multiplication problems showing how to use bundled straws to develop the method for short multiplication.

Problem 1: involves 10's & 1's with **no** carrying

Problem 2: involves 10's & 1's **with** carrying

Problem 3: involves 100's, 10's & 1's **with** carrying

Three problems are included here as models. However, do as many of these sort of problems with your students as are needed to establish the method for short multiplication. There is a list of possible examples following the worked problems that you can use for further practice.

The formal numerical steps are included in brackets at each stage of the solution. Introduce these to your students only after doing a few examples with the straws alone.

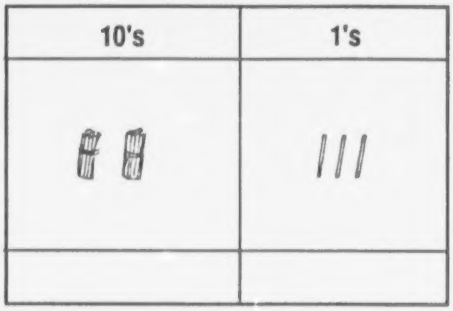
Note: Although we have not included illustrations here, MAB blocks could be used instead of straws. Refer to the Two Sessions in Chapter 3, *Building Addition Skills* and *Building Substraction Skills* for guidelines on using MAB blocks.

PROBLEM 1

"Daffodil packets contain 23 bulbs. Jo bought 3 packets. How many daffodils will she have to plant?"

First represent one packet, by laying out bundled straws on the operations table to represent 23 like this:

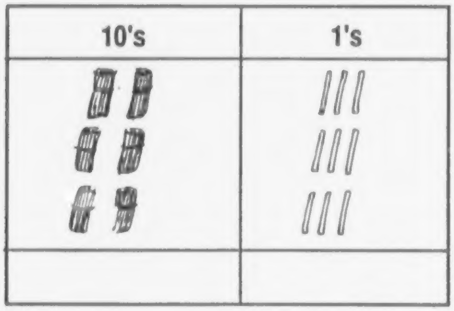
ie.



23

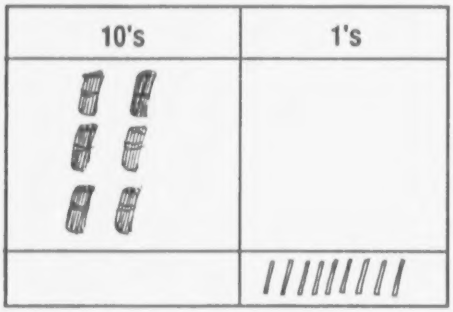
The problem calls for 3 lots of 23; so add 2 more lots of bundled straws each equivalent to 23

ie.



$$\begin{array}{r} 23 \\ 3\times \\ \hline \\ \hline \end{array}$$

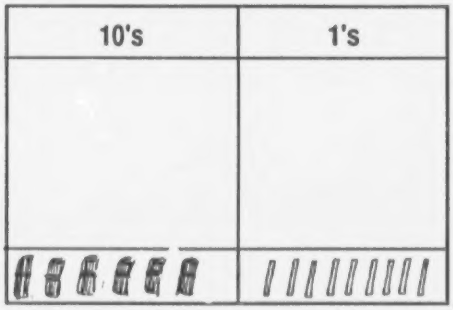
Now count the total no. of straws. Start with the individual straws.



$$\begin{array}{r} 23 \\ 3\times \\ \hline 9 \\ \hline \end{array}$$

There are 3 lots of 3. ie. 3 x 3 = 9 individual straws

Now count all the bundles of ten.



$$\begin{array}{r} 23 \\ 3^{\times} \\ \hline 69 \\ \hline \end{array}$$

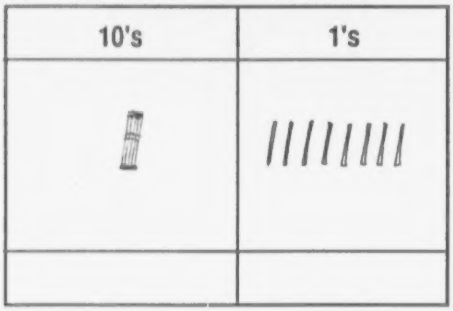
There are 3 lots of 2 bundles. ie. 3 x 2 = 6 bundles of ten straws

PROBLEM 2

Hannah's farm is 18km from town. She makes 2 return trips into town each day to take her children to and from school. How many kilometres does she travel each day?

Working as a group, layout bundled straws on the operations table to represent 18 km. for one trip.

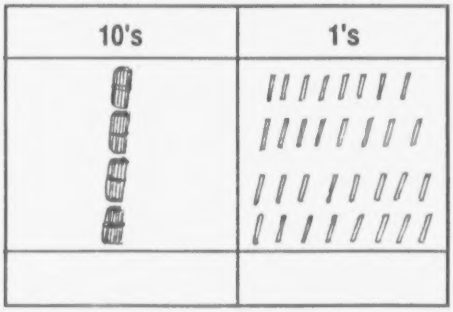
ie.



18

The problem calls for 4 lots of 18, so now put 3 more lots of straws representing 18 on the operations table.

ie.



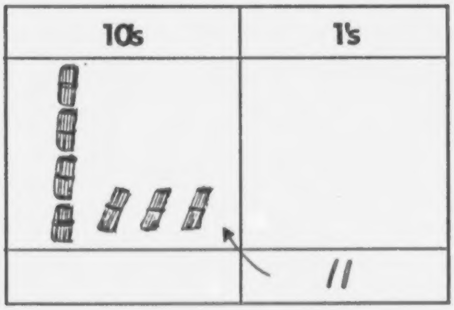
$$\begin{array}{r} 18 \\ 4^{\times} \\ \hline \\ \hline \end{array}$$

Now count the total number of straws. Start with the individual straws.

There are 4 lots of 8 straws. ie. 4 x 8 = 32 straws

These can be bundled together in tens, giving 3 bundles of ten and 2 straws left over.

ie.



$$\begin{array}{r} {}^{3}18 \\ 4\ \times \\ \hline 2 \\ \hline \end{array}$$

Now count all the bundles of ten straws. There are 4 bundles already and 3 more. ie. 7 bundles of ten straws.

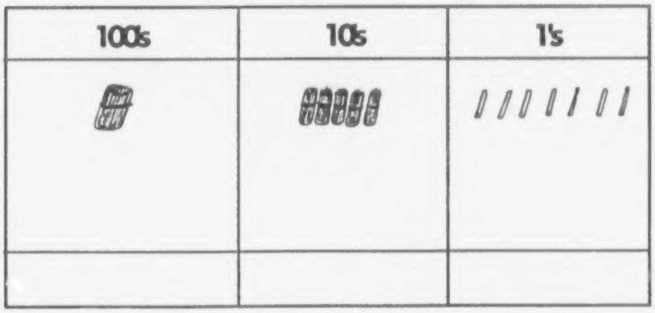
$$\begin{array}{r} {}^{3}18 \\ 4\ \times \\ \hline 72 \\ \hline \end{array}$$

PROBLEM 3

Lou is making curtains. He needs 2 fabric lengths, each of 157cm. How much fabric does he need altogether?

Put out bundled straws to represent 157 for one drop.

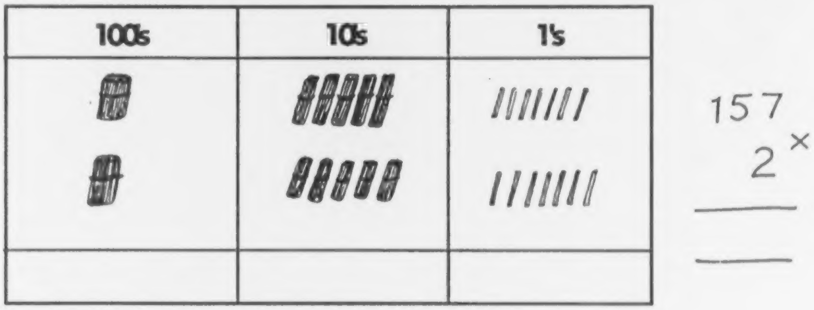
ie.



157

The problem involves 2 lots of 157, so now put another lot of straws representing 157 on the table.

ie.



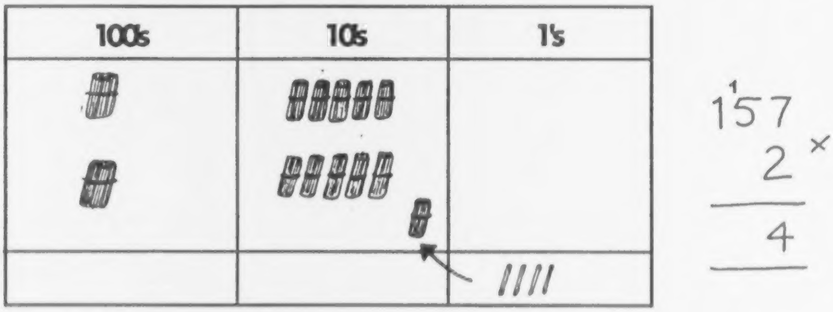
Now count the total number of straws.

Start with the individual straws.

There are 2 lots of 7, ie. 2 x 7 = 14 individual straws

These can be bundled together in tens, giving 1 bundle of ten and 4 straws left over.

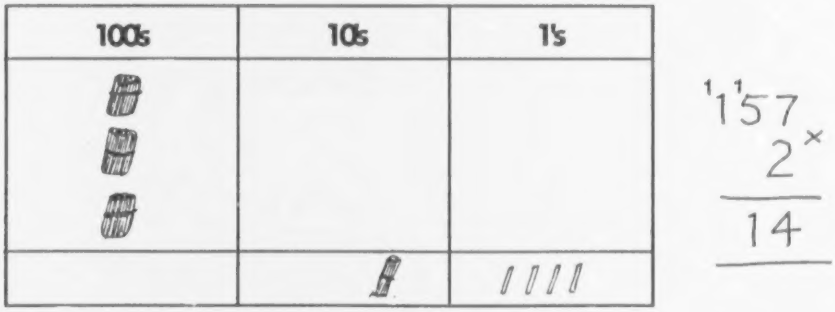
ie.



Now count all the bundles of ten straws. There are 2 lots of 5 and 1 more. ie. 11 bundles of ten straws.

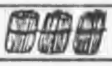
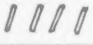
These can be bundled together in hundreds, giving one bundle of a hundred and one bundle of ten left over.

ie.



Now count all the bundles of 100 straws. There are 2 lots of 1 and 1 more.
ie. 3 bundles of 100 straws.

ie.

100s	10s	1's
		

$$\begin{array}{r} {}^{1}1\,{}^{1}5\,7 \\ 2\;{}^{\times} \\ \hline 314 \\ \hline \end{array}$$

EXAMPLES FOR FURTHER PRACTICE

Use as many of these with your students as are needed for them to understand the method for short multiplication.
When this has been achieved, students can do **Worksheet 1.** Have the straws available if they are needed.

A. 10's and 1's with **no** carrying

1. 13 x 2
2. 42 x 4
3. 33 x 3
4. 24 x 2
5. 21 x 4
6. 20 x 3

B. 10's and 1's with carrying

1. 26 x 3
2. 47 x 2
3. 18 x 4
4. 35 x 2
5. 23 x 4
6. 19 x 5

C. 100's, 10's and 1's with carrying

1. 152 x 3
2. 260 x 2
3. 421 x 2
4. 69 x 5
5. 134 x 7
6. 309 x 3

The examples above do not go beyond the 100's.

Following are some examples which involve 1,000's. Bundling of straws for lots of 1,000 becomes tedious and straw consuming! Therefore, these problems are probably better handled by discussion of what *would* happen with the straws.

D. 100's, 10's and 1's with carrying into the 1,000's position

1. 273 x 5
2. 420 x 4
3. 382 x 3
4. 711 x 8
5. 163 x 9
6. 508 x 6

MULTIPLICATIONS SKILLS

Worksheet 1

1. (i) 21 x 3
   (ii) 46 x 2
   (iii) 150 x 4

2. What are 6 lots of 13?

3. What is 213 multiplied by 4?

4. Find (i) 7 lots of 22
   (ii) 5 lots of 341
   (iii) 8 lots of 120

5. Multiply 563 by 2.

6. Multiply 7 by 108.

7. What are 9 lots of 27?

8. (i) 475 x 5
   (ii) 813 x 4
   (iii) 927 x 6
   (iv) 3 x 708

DOUBLING

Preskills

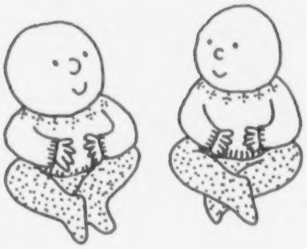
- Two times table

Skills Developed

- Quick way of doubling
- Place value understanding

Materials

- Worksheet



Many everyday calculations are done without formal setting out. This session shows students that informal methods are acceptable for calculations and invites them to share those they use themselves.

A special session on doubling is provided because multiplication by two occurs quite frequently and this demonstrates a useful mental strategy.

SESSION OUTLINE

Begin by talking about situations where you have to double.

For example: A family has twins.
Will all the costs be doubled? eg. clothes, pusher.
Will everything take twice as long? eg. feeding. (You may even have some first hand experience in the group!)

Think of other occasions when you would multiply by 2 or double.

eg. double time (for pay)
recipes - doubling the amount
travelling to and from - time and distance
shopping - does a large packet cost twice as much as a small one.

Go through the process of working these out as shown below. The important aspect is getting a method of doing this mentally rather than writing down the whole multiplication.

	Problem	Think or Jot down
eg:	Double 35	Double 30 and double 5 60 + 10 = 70
	Double $2.60	Double $2 and double 60c $4 + $1.20 = $5.20
	Double 180	Double 100 and double 80 200 + 160 = 360

Double 1hr 25min
Double 1hr and double 25min
2hr + 50min = 2hr 50min

Double two and a half hour
Double 2hr and double half hour
4hr + 1hr = 5hrs

Note: Using this method we double the largest part first rather than with a formal method which attacks the small units first.

Give the students some examples to do themselves. They might like to jot down an intermediate step or the answer only; discourage using the usual formal multiplication. Either read the numbers out or write them on the board and ask students to double them:

15	45	75	116
25min	45min	1hr	15min
$3.60	$4.50	$1.89	$7.30

Students should now attempt **Worksheet 1** for more practice with the method. Once again ask them not to write out the formal multiplication and stick to doubling the largest part of the number first.

A discussion about this method, after having used it, could be valuable. Amongst the group some students may have their own ways of doing mental calculations (often with intermediate steps, but not following the formal written method). Give them opportunity to explain their own preferred methods.

Extension: Multiplying by four by doubling and doubling again.

	Number	Double	Four times
eg. 250 x 4	200	400	800
	50	100	200
	Total	500	1000

		Double	Four times
$1.25 x 4	$1	$2	$4
	25c	50c	$1
	Total	$2.50	$5

DOUBLING Worksheet 1

1. If you want to make double quantity of this recipe what amounts would you use?

Honey biscuits	Double Quantity
1 and a half cups flour	
2 tablespoons custard powder	
quarter cup sugar	
half cup rolled oats	
125g butter	
1 tablespoon honey	

Recipes
REC IPES

2. A plane trip costs $325 one way.
How much would it cost for 2 people one way?
How much would it cost for 2 people for a return trip?
(A return trip is the same as two single tickets).

3. One litre of milk costs 87c.
What will 2 litres cost?

4. 150 people were expected at a concert, but twice as many came.
How many people was that?

5. An electrician said he would come in 45 minutes but he took twice as long to arrive.
How long was this?

6. A waitress was paid $12.50 per hour and double time on Sundays.
How much was she paid each hour on Sunday?

SOME SHORT CUTS IN MULTIPLICATION

Pre-skills

- Concept of multiplication

Skills Developed

- Multiplication by 10, 100 etc.
- Multiplication short cuts
- Estimation of answers to calculations

Many people take for granted the skill of adding zeros when multiplying by 10, 100, 1000 etc. However many of our students need to spend time learning and practising this before it becomes obvious to them. The skill is very useful in a society using the metric system, which is based on tens.

This session introduces this quick method of multiplying and also uses it for short cuts to multiplying by numbers such as 99, 50, 20, 200.

SESSION OUTLINE

To set these multiplications in some context pose these problems:

- *Wine is $2 a glass at a fundraising BBQ. How much will be earned if they sell 10 glasses?*

Discuss different methods by which students might arrive at their answers.

These could include:

- 2+2+2+2+2+2+2+2+2+2
- use of a written multiplication table
- use of a calculator
- adding a zero

Record the answer as 10 x 2 = 20

Similarly for the next few problems - discuss, then record.

- *Hamburgers sell at $3. How much will 10 cost?*
- *A steak is $5. How much for 10 steaks?.*

You will have now recorded
10 x 2 = 20
10 x 3 = 30
10 x 5 = 50

Encourage students to find the pattern themselves. Discuss the ease of multiplying by 10 by adding zero. Make up more examples like the above and ask students to write down the answers straight away using the pattern.

Once multiplying by 10 is established move on to discuss the following sequence of problems. Students should use calculators if in doubt.

- *If 100 glasses of wine are sold at $2 each how much is made?*
- *100 of the $3 hamburgers are sold. How much money is taken?*
- *How much for 100 steaks at $5 each?*

Record 100 x 2 = 200
100 x 3 = 300
100 x 5 = 500

ask students to predict answers to questions like:

100 x 9 = ?
100 x 7 = ?
100 x 6 = ?

until the rule of adding two zeros is established.

Extension 1: Multiplying by 20 or 200

The methods we suggest for basic numeracy students to perform these multiplications would be to work out 10 lots or 100 lots and then double the amount.

eg. for 20 x 3 the reasoning would be:
20 is double 10
10 lots of 3 = 30 (add zero)
20 lots of 3 = 60 (double)

Use the following problems to set contexts for students to practise the methods outlined above.

- *Sam's trip from home to work is 4km.*
  How far would he travel if he did the trip 20 times?
- *Su Hung fits 6kg of apples in her bucket. She picks 20 buckets.*
  How many kilograms?
- *There are 8 muesli bars in a packet. Susie bought 20 packets for a children's picnic.*
  How many did she get?
- *It takes Rosa 2 minutes to address one envelope.*
  How many minutes will she take to address 200 of them?

Worksheet 1 can be done by students alone or as a verbal exercise in the class.

Extension 2: Multiplying by 30, 40, 50 etc.

Once again introduce these problems in a context with the following story.

> *There are 30 vitamin C tablets in a bottle. If you buy 4 bottles (because the shop doesn't have a big one) how many tablets will there be?*

When the problem has been expressed by students as 30 x 4 or 4 x 30, ask them to find a solution in any way they can. Calculators can be used!

Write it as 30 x 4 = 120 or 4 x 30 = 120
and compare it to 3 x 4 = 12 or 4 x 3 = 12

See if they can see a quick rule or shortcut for the calculation.

> [You are looking for the idea of multiplying together the two non-zero digits and adding the zero at the end.]

As a class exercise ask students to try the rule to find an answer to these multiplications and check them using a calculator.

50 x 3, 4 x 60, 7 x 40, 8 x 30

Extension 3: Multiplying by 95, 50, 15

Many short cuts can be practised with your class depending on how receptive your students are. Here we outline some commonly used examples.

Multiplying by 95

- *What is the cost of 6 items at 95 cents each?*

The problem can be written as 6 x 95

Short cut: 95 is 5 less than 100
so consider 6 x 100 = 600 cents (or $6)
but this is 6 x 5 = 30 cents too much
so now take away the 30 cents
which leaves $6 - 30c = $5.70

This method is used by shopkeepers when working out change. See if the class can act out some examples.

Multiplying by 50

- *50 bags of oranges each 4 kilograms. What weight of oranges?*

The problem translates to 50 x 4

Short cut:
50 is half of 100
so consider 100 x 4 = 400
now halve it which gives 200
sot the answer is 200kg of oranges

Multiplying by 15

- *A cask holds 4 litres. How many litres will 15 casks hold?*

The problem can be written 15 x 4

Short cut:
15 is 10 plus 5
5 is half of 5
so consider 10 x 4 = 40
and half of 40 is 20
now add these: 40 + 20 = 60
so the answer is 60 litres

Note: A technique similar to this is used by business people in working out 15% sales tax.

You would not expect formal setting out for any of these problems. Encourage the students merely to jot down the intermediate steps if they need to.

Suggestions:

Ask each student to generate at least two of these kind of problems for the others to solve.

Use a supermarket catalogue to obtain quantities and prices for other examples.

LEARNING MULTIPLICATION TABLES

Skills Developed

- Automatic recall of mutliplication tables

Materials

- Worksheets
- Counters or coins
- Cards

In this session we provide some methods that you can use to assist your students learn multiplication tables.

Many students feel really bad because they still don't know their tables 'after all these years'. Such students are keen to try again when given some new strategies. However not all students will have this motivation (see discussion in introduction to *Multiplication and Division*).

Sometimes only a few shaky facts will lead to students becoming anxious about **all** tables, and so a small investment of effort will give a large return in confidence. Certainty with multiplication and addition facts will go a long way towards overcoming maths anxiety.

If students do learn their tables it is important that they work towards recalling **random** facts and do not have to recite the tables in order eg. to find 7 x 4 = 28, they do not have to go through 7, 14, 21, 28.

SESSION OUTLINE

Method 1 MULTIPLICATION GRID

Materials

- Worksheet 1

Show students how to fill in the grid on Worksheet 1. 11 and 12 times tables are often omitted in these days of the metric system; include them if your students want them by filling in the two extra rows and columns on the grid.

Students should first fill in the facts they are confident about. This may leave only a few spaces of uncertainty. They can use a calculator, model with counters or use tables on the back of an exercise book to fill in these spaces.

Check that the final grid is correct so that students can keep it for reference.

Note Some students will prefer tables set out 'the old way' in columns. They may find these on the back of exercise books.

Look for patterns along columns (or rows). These sometimes can act as memory aids.

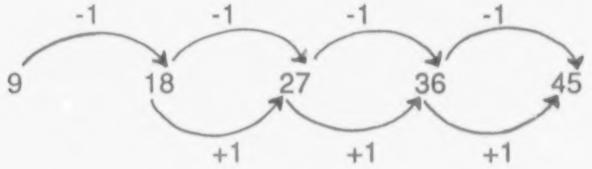
eg. 2, 4, 6, 8, 10 tables: have even numbers

5 times table: end in 5 or 0

10 times table: end in 0

3 times table: the digits add to give 3, 6 or 9.
For instance 15: 1+5 = 6
18: 1+8 = 9

9 times table: as the tens digit goes down by one, the units digit increases by one .

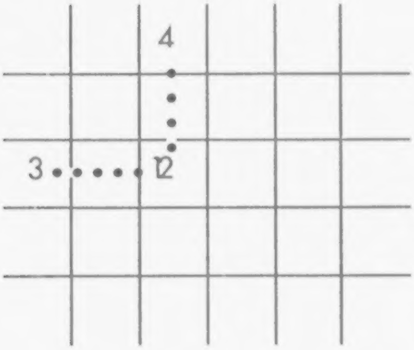


9 times table: the digits add to give 9.
For instance: 18: 1 + 8 = 9
27: 2 + 7 = 9
36: 3 + 6 = 9

The grid can also be used for division.

eg. 12 ÷ 4. Look for 12 in the main part of the grid along a row or column headed by 4. Find the row or column number which goes with it, ie. 3.

These 3 squares show us that 4 x 3 = 12
or 12 ÷ 4 = 3
also 12 ÷ 3 = 4



Materials

- Cards

Method 2 TABLE FLASH CARDS

This method is a long term strategy which may be carried out at home over a few weeks.

Preparation

Cut card into pieces approx. 10 x 3cm or use precut index cards or blank invitation cards from the newsagents.

Help students make their own flash cards of the multiplication tables, concentrating on one table at a time.

Example:		
	7 x 6 =	**Side I**
	7 x 6 = 42	**Side 2**

Students place their cards in a pile, **side 1** uppermost. They take the top card, read it and give an answer. Check the answer instantly on **side II** by turning the card. If correct, put the card aside. If not, return to the bottom of the pile. Repeat with next card etc.

As students become more proficient they have the satisfaction of seeing their pile of certainties getting bigger and their pile of uncertainties getting smaller!

Another day work on another table. Later, shuffle all the tables together, and check that the tables have been memorised randomly.

Materials

- Worksheet 2

Method 3 TANGLE TABLES

Use **Worksheet 2** and ask students to fill in the small grids provided. Students can re-use these or make more of their own, to practise on the train or at spare moments. This is a way of learning isolated facts - the choice of number on the sides will determine which tables are practised.

Method 4 BINGO

Although the whole group could play this game, it is also suitable for smaller groups or individuals.

Materials

- Bingo Worksheets 1, 2 and 3
- Counters or coins

Preparation

Paste **Worksheets 1 and 2** on cardboard and cut out individual bingo cards for the students. These could be laminated, and re-used.

Worksheet 3 provides separate cards of each multiplication for you. Paste this on cardboard also and cut out the individual multiplications.

Playing the Game

- Give each student a bingo card.
- Shuffle the question cards and then either you can turn one over and call out the multiplication, or a student can do this.
- If a student (or students) finds the answer to the multiplication on their card, they place a coin or counter on the appropriate square.
  Give everyone a chance to find it by going slowly initially and even asking what the answer is.
- Work through the question cards until one student fills a grid and calls out 'Bingo'.
- If you keep the question cards in the order you call them, the filled Bingo card can be checked by you, or another student.

Variation

- If students find all the tables at once too much, make Bingo Cards and question cards of 2, 3, 4, 5, 10 times tables only.

MULTIPLICATION GRID   Worksheet 1

x	0	1	2	3	4	5	6	7	8	9	10
0											
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

TANGLE TABLES

Worksheet 2

Fill in each grid.

x	7	3	5
8			
6			
2			

x	4	5	10
5			
4			
2			

x	6	1	3
3			
7			
4			

x	8	4	0
9			
2			
3			

First choose the numbers for the sides of the grid and then fill it in.

x			

x			

x			

x			

BINGO **Worksheet 1**

Paste these on cardboard and cut out.

3	16	12	24
27	6	54	60
56	48	7	32

8	32	45	28
0	24	80	81
28	36	16	72

25	21	10	36
40	0	54	72
60	50	45	8

3	12	0	15
42	64	60	18
49	27	10	30

BINGO **Worksheet 2**

Paste these on cardboard and cut out.

25	63	21	16
10	12	36	0
6	80	28	15

48	8	7	42
32	50	81	49
14	45	15	18

56	60	3	24
25	14	14	49
7	54	15	0

70	27	40	8
64	12	60	21
6	72	32	25

MD38

Paste these on cardboard and cut them out.

3x0	2x2	3x5	9x4	9x9
1x1	3x2	6x3	10x4	9x10
1x3	4x2	7x3	5x5	10x10
4x1	2x5	8x3	6x5	10x6
5x1	2x6	3x9	7x5	7x7
1x6	2x7	10x3	8x5	8x7
7x1	8x2	4x4	9x5	9x7
8x1	9x2	5x4	5x10	7x10
1x9	2x10	6x4	6x6	8x8
1x10	3x3	7x4	6x7	9x8
6 x 9	3x4	4x8	8 x 6	10x8

CONCEPT OF DIVISION

Pre-skills:
- Counting

Skills developed:
- Concept of division
- Use of "÷" symbol

Materials:
- School money
- Blocks, counters, or beans etc.
- Scissors and paper

In this session we consider a number of real life situations where a **'sharing out'** is required. At this stage, these problems are tackled using hands-on materials such as blocks, beans, money etc. to share out, and then count how much each person has.

No formal method is introduced.
However, after a number of examples have been discussed, the division sign "÷" is introduced and the problem recorded mathematically.

eg. "$28 **shared out between** 4 people"
is written as: $28 \div 4 = 7$

PREPARATION

Read the introductory notes to *Multiplication and Division*

SESSION OUTLINE

Presented below are a number of "real-life" division problems. Tackle these problems with your students as a group, and have "hands-on" material available to aid in their solution.

Example:
Choose a number less than 100 that is a multiple of the number of students in your group. Make this number the $ winnings of your group in a lottery. How much money would each student receive?

eg. *4 students in your group win $20.*
How much does each student get?

Provide your group with play money or blocks, counters, etc and have them share out the $20 total among the people. Counting each person's share will give the answer. Record on the board as:

$20 shared between 4 gives $5 each.

Continue in this way for the problems below:
(Read out the problem and make sure the situation is clear for the whole group before going on with the solution).

1. *A group of 4 friends go to dinner together at a Vietnamese restaurant. They order 3 serves of spring rolls which come as a total of 9 spring rolls. They share them out equally. How much does each person get?*

2. *A birthday party of 12 children is being driven to the beach for a picnic. 3 cars with drivers are available. How many children will go in each car?*

   (extension: make the number of children 13, and discuss the best way to handle the remainder.)

3. *8 students make a group booking to go to the theatre. The total cost of the seats is $56. How much will each student have to pay?*

4. *5 other students make a group booking to go to a more expensive theatre. The total cost of their seats is $56. How much will each of these students have to pay?*

5. *2 very hungry friends share 3 pizzas between them. How much does each person get?*

6. *8 friends having a snack share 2 pizzas between them. How much does each person get?*

7. *Jack is having 5 friends around for dinner. He buys 4 pizzas. How much does each person get?*

Note: If more practice is needed, ask your students to make up "sharing out" problems.

For each of the above problems you will have recorded the solution on the board in a form such as:

9 spring rolls ***divided between*** *4 people gives 2¼ each*

Go back to these solutions and below each rewrite using the "÷" symbol.

eg.	*9 spring rolls*	***divided between***	*4 gives*	*2¼ each*
	9	÷	4 =	2¼

Explain that the "÷" symbol is a short hand for the expressions you have been using such as:
"divided between"
"shared out"
"chopped up"

Rub out the English version, leaving only the mathematical version, and ask your students to read them aloud.

In examples 5, 6, 7 introduce division written as a fraction

ie. $3 \div 2 =$ 3/2 or $1^1/2$

It is interesting to note that the division symbol "÷" is actually an abstracted version of

$$\frac{\text{one number}}{\text{another number}}$$

where the two dots replace the two numbers.

BUILDING DIVISION SKILLS

Pre-skills:
- Concept of division

Skills developed:
- Short division

Materials:
- Drinking straws cut in half (see session *Building Addition Skills*)
- Worksheet 1

In this session, the method for short division is developed.

SESSION OUTLINE

Below are three worked division problems showing how to use bundled straws to develop the method for short division.

Problem 1 : involves 10's & 1's with **no** carrying
Problem 2 : involves 10's & 1's **with** carrying
Problem 3 : involves 100's, 10's and 1's **with** carrying

Work through these problems with your students as a group.

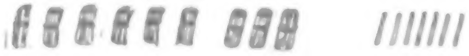
Only 3 problems are included here as models. But do as many of these sort of problems as your students need to establish the method for short division. There is a list of possible examples following the worked examples for further practice.

The formal numerical steps are included in brackets at each stage of the solution. Introduce these to your students only after doing a few examples with the straws alone.

Problem 1

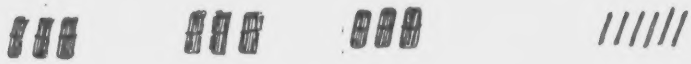
96 people are going on a bus trip to the snow.
There are 3 buses going. Divide the people equally between the buses.

Working as a group, lay out bundled straws on the table to reprsent the 96.



Ask your students to distribute the nine 10's bundles between the 3 buses

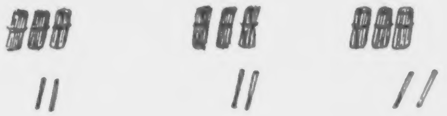
ie. Bus 1 Bus 2 Bus 3



$$\begin{array}{r|l} 3 & \underline{96} \end{array}$$

Now ask your students to divide up the 6 single straws between the 3 buses

ie. Bus 1 Bus 2 Bus 3



$$\begin{array}{r|l} 3 & \underline{96} \\ & 32 \end{array}$$

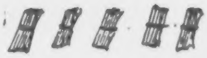
Now each bus can be seen to carry 32 people

ie. 96 ÷ 3 = 32

Problem 2

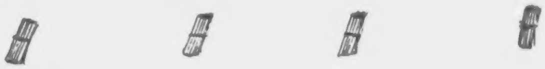
A deck of 52 cards is dealt out to 4 people.
How many cards does each player get?

Model the number 52 with bundled straws



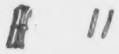
Share out the 5 bundles of 10 straws amongst the 4 people

Player 1 Player 2 Player 3 Player 4



$$\begin{array}{r|l} 4 & \underline{52} \\ & 1 \end{array}$$

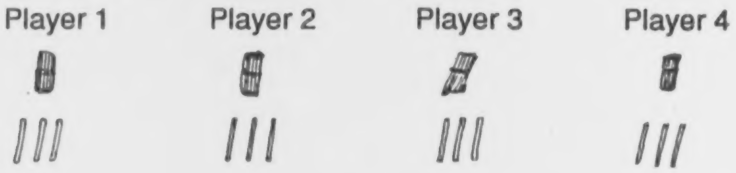
Remaining Straws



Each player received one 10. But there is one bundle of 10 left over. Remove the elastic band, so that these straws become "one's". Together with the 2 original single straws, this makes a total of 12.

Share these out between the players.

$4\,\underline{|\,5{}^{1}2}$
13


Player 1
Player 2
Player 3
Player 4

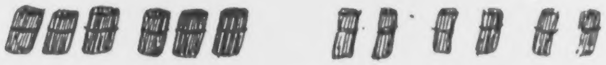
Now each player has 13 cards.

ie. 52 ÷ 4 = 13

Problem 3

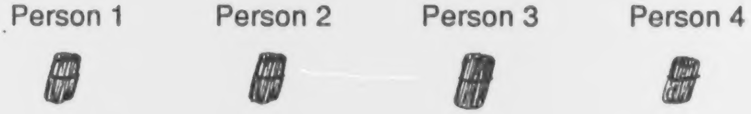
4 people enter a lottery as a group and together win $660.
How much does each person win?

Model the number with bundled straws

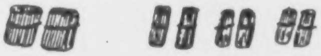


Share out the six bundles of 100 straws between the 4 people

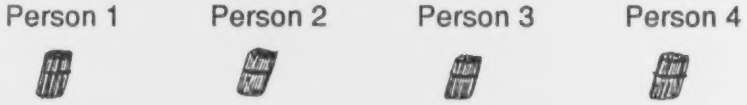
$4\,\underline{|\,660}$
1


Person 1
Person 2
Person 3
Person 4

Remaining Straws

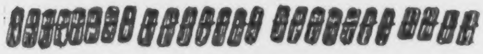


Each person receives one bundle of 100. But there are 2 bundles of 100 left over. Remove the elastic band so that these straws become "tens" This will make a total of 26 "tens".
Share these out between the 4 people.

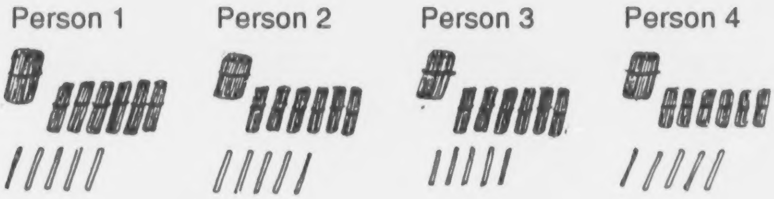

Person 1
Person 2
Person 3
Person 4

Remaining Straws

$4\,\underline{|\,6{}^{2}60}$
1



Each person receives 6 bundles of 10. But there are 2 bundles of 10 left over. Remove the elastic bands so that these straws become "ones". Share these 20 straws out.



$$\begin{array}{r} 4\,\underline{\big|\,6\;{}^{2}6\;{}^{2}0} \\ 165 \end{array}$$

Now each person has $165.

ie. 660 ÷ 4 = 165

Here are some further examples to use with the straws. Some of these examples have remainders. Discuss with your students possible ways of recording these "leftovers". (See the Introductory Notes to *Multiplication and Division.*) Use as many of these with your students as are needed for them to understand the method for short division.

When this has been achieved, students can do **Worksheet 1.** Have the straws available if they are needed.

Examples involving 10's & 1's, with **no** carrying

A.	1. 42 ÷ 2	3. 56 ÷ 5	5. 95 ÷ 3
	2. 68 ÷ 2	4. 84 ÷ 4	6. 78 ÷ 7

Examples involving 10's & 1's, **with** carrying

B.	1. 45 ÷ 3	3. 65 ÷ 5	5. 91 ÷ 7
	2. 72 ÷ 4	4. 88 ÷ 6	6. 59 ÷ 4

Examples involving 100's 10's & 1's, **with** carrying

C.	1. 264 ÷ 2	3. 546 ÷ 3	5. 896 ÷ 7
	2. 272 ÷ 2	4. 672 ÷ 4	6. 954 ÷ 6

DIVISION SKILLS

Worksheet 1

1. Divide 64 by 4.

2. Share $90 between 6 people

3. (i) 81 ÷ 3
   (ii) 428 ÷ 4
   (iii) 655 ÷ 5
   (iv) 97 ÷ 8

4. Divide 48 children amongst 3 buses.

5. 8 people share 100 apples. How many do they each get?

6. 57 divided between 3 gives ....?

7. Divide 260 by 5.

8. 600 divided between 4 gives ....?

PHONE CALLS

Skills Developed

- Application of multiplication and division skills
- Use of information pages in the phone book

Materials

- phone book
- a recent phone bill

In this session students work as a group to practice multiplication and division by examining various aspects of telephone charges. We look at the difference between making calls from home and a public phone box. Students use the information pages at the front of the phone book and a phone bill to get the information needed for this activity.

SESSION OUTLINE

Discuss the situation outlined in the problem given here:

> *Joe, who is 19 and living at home, spends a lot of time on the phone. His parents would like him to contribute to the cost by paying for his calls although they do not wish him to pay for phone rent. Joe wants to know the approximate amount this will be.*

Over a few weeks of counting his calls he finds that in an average week he makes:

20 phone calls locally
1 STD call to his friend in Bendigo
(150km from Melbourne)

(All calls last about 20 minutes)

1. Local Calls from Home

Look at the phone bill for the cost of a local call from home. (Each unit is the cost of a local call).

Ask the students to try and calculate the cost of Joe's local calls for one week. Make a record of this before going on to the STD part of his bill.

2. STD Call from Home

Find the chart in the front of the phone book. Students will find 3 rates - Day, Night and Economy.

Ask questions like:

- *When is it cheaper for Joe to call Bendigo?*
- *Work out the cost of ringing Bendigo (150km) for 20 minutes at this rate. Record this.*
- *Discuss what his total would be.*

Joe wonders whether it would be cheaper to make all his calls from public phone boxes. Can we work it out for him?

3. Local calls from the public phone

- *How much does it cost to make a local call in the box?*
- *What would Joe's 20 calls cost?*

4. STD calls from the public phone

- *Where do we look to find out how much his STD call will be?*

Use the chart on the same page as for STD.
Note This is more difficult to work out as it is given in seconds for every 30c (in 1990). Although all students may not follow the calculations they will be interested in the charge. (Calculators should be used as the level of calculations are quite difficult).

Example

The day rate to Bendigo from Melbourne.
Each 30c will buy you 38 seconds phone time.
Now 20 minutes = 20 x 60 = 1200 seconds
How many 38 seconds in 1200 seconds?
Using the calculator, 1200 ÷ 38 = 32 (rounded off)

So Joe would need 32 x 30c for 20 minutes ie. $9.60

5. Operator Connected Call

Joe's friend needs to call him from a phone box in Bendigo to change arrangements for the weekend, but has no coins on her. She has an operator connect the call and reverse the charges.

- *How much will this cost?*
  See 'Operator Services and Charges' on an earlier page.

Some Further Ideas with the Phone Book

1. Have a look at other information in the front section of the phone book.

   eg. Emergency numbers, community numbers, STD area codes, Government directory, ISD

   The students may have some particular interest or request to follow up.

2. Look at the phone bill and find the service and equipment charge. This is the cost of having the phone on. Look at the cost of metred calls. Assuming each unit is a local call can you compare this with making the same calls from a public phone box. What is it costing for the convenience of having a phone at home?

3. Have a look at Telecom Yellow pages for Government Easy Guide, Melbourne map and Melbourne and Surrounds map. This could provide a separate session on day trips from Melbourne, working out travelling time, and map reading.

4. International Calls (ISD)

   Ringing home to..................................(choose a country).

   Discuss issues such as:

   - *What ISD numbers do you have to ring?*
   - *What are the best times to catch people at convenient times over there?* (This involves looking at time differences)
   - *What are the cheapest times?*
   - *How much would a call cost?*

MULTIPLICATION AND DIVISION - WORD PROBLEMS

Preskills
- Multiplication and division skill using calculator or pen and paper

Skills Developed

- Recognition of when to use multiplication and division

Materials
- Calculator (optional)
- Worksheet 1-5

This session introduces written problems which put multiplication and division in a variety of contexts. These problems are an essential extension of learning the mechanical method because they provide practice at using the skills in appropriate everyday situations.

A calculator could be used when solving the problems, or to check the answers; the main emphasis here is applying the correct operation rather than the calculation.

A Note about the Worksheets

All of the worksheets contain a selection of multiplication and division problems. The numbers involved are not difficult; the main task for students is to understand the problem, decide the suitable operation and ensure the numbers are in the correct order.

Worksheet 1:
Simple multiplication and division problems with whole number answers.

Worksheet 2:
Involves remainders - the only worksheet to do so. Students should decide the best way to express the remainders for each problem.

Worksheet 3:
Comparisons of prices for bargain packs versus single items.

Worksheet 4 and 5:
Mixed problems.

Worksheet 6:
Problems using real life fact and figures taken from newspapers and other sources.

SESSION OUTLINE

Introducing the problems

In order to give students some ideas about tackling the worksheet problems go through a couple with the group before they begin.

Example 1

If you buy 4 cans at $1.20 each what is the total cost?

Students will probably suggest addition or multiplication. (Either are acceptable)

ie. $1.20 + $1.20 + $1.20 + $1.20 = $4.80
Or $1.20 x 4 or 4 x $1.20 = $4.80

Multiplication refers to a number of 'lots of' the same amount, eg. **4 lots of $1.20**, or an event happening more than once as in the next example.

Example 2

Each time I go swimming I do 10 laps, how many laps do I swim after 3 visits to the pool?

Example 3

*20kg of fresh apricots are shared between 4 people.
How much do they each get?*

Students will probably suggest division. Make sure that they can write it in the right form, ie. 20 ÷ 4 =

Ensure that students realise division refers to sharing or dividing something up evenly and that the original amount comes first when writing 20 ÷ 4 and when entering it on a calculator.

Doing the worksheets

Only present a few problems at a time. If you think that there are too many on one worksheet for your particular students, write one at a time on a display card or on the board. Students should feel free to discuss the problem with each other, particularly when trying to understand the meaning of the problem before solving it.

More Word problems

See references with *Addition & Subtraction Word Problems.*

Extensions

1. After doing **Worksheet 3,** visit a supermarket or use advertising catalogues to discuss the cheapest buy. eg. 6 bottles of drink in a pack costs $2.40. How much does 1 cost?

2. **Worksheet 5.** Try to find more facts and figures from newspapers or use students' interests to provide the basis for more problems.

   eg. *A national payrise of $5 per week is awarded.*
   How much would it be per month? Per year?

   The figures will not always be easy and approximation may be needed or calculators can be used.

MULTIPLICATION AND DIVISION Worksheet 1

1. How many 20c stickers can be bought with $2?

2. Bread rolls are 45c each. What would 6 rolls cost?

3. Peter saves $10 a week for a year.
How much does he have at the end of a year?

4. Dianna wants to buy a stereo for $1000.
She saves $20 a week.
How many weeks until she can buy it?

5. Con thinks he will spend about $50 each day of his holidays.
How much should he take for a fortnight away? (A fortnight is 2 weeks)

MULTIPLICATION AND DIVISION

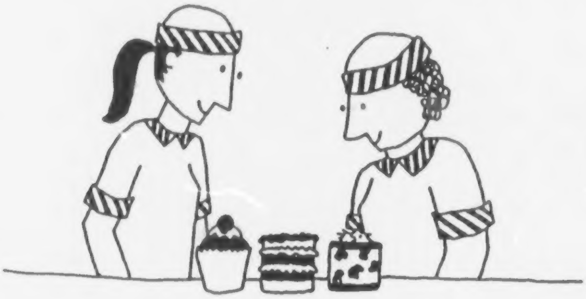
Worksheet 2

1. Lunch for 2 friends costs a total of $11.65.
   How much should each person pay?

2. A weight reducing diet recommends 5000 kilojoules for each day.
   How many kilojoules for each of the 3 meals in the day?

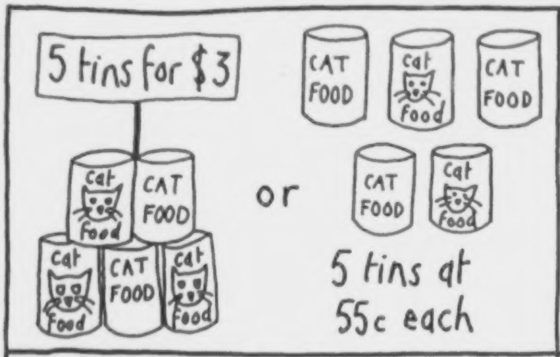
3. 4 boys share out 10 golf balls they collected.
   How many for each boy?

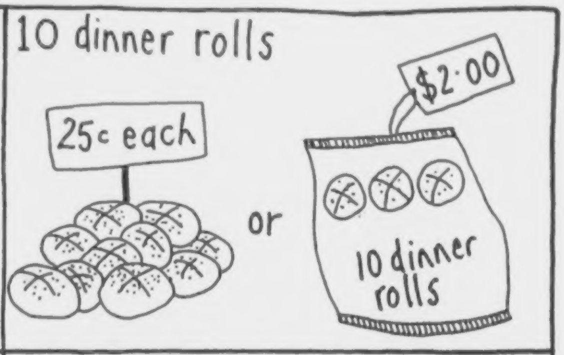
4. Maria and Josie work at a cake shop.
   There are 3 cakes left at the end of the day.
   How much could they each take home?

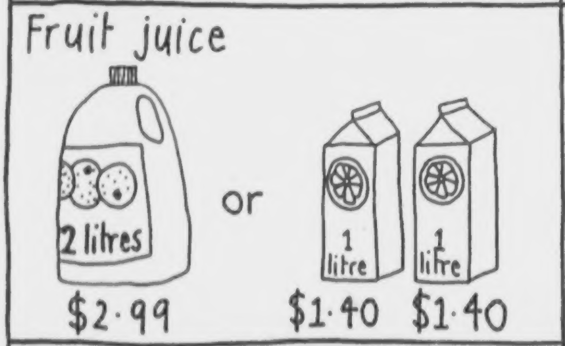


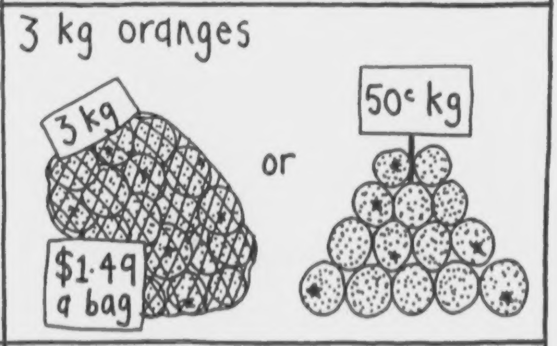
MULTIPLICATION AND DIVISION Worksheet 3

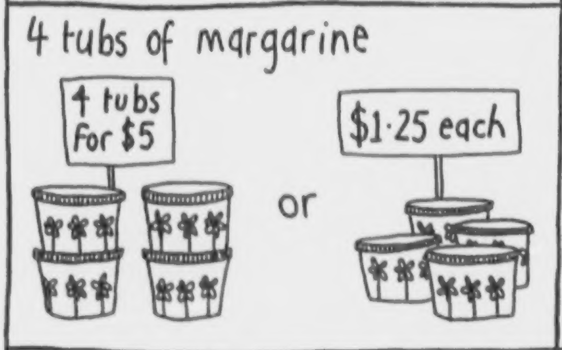
Which will be the cheaper buy?

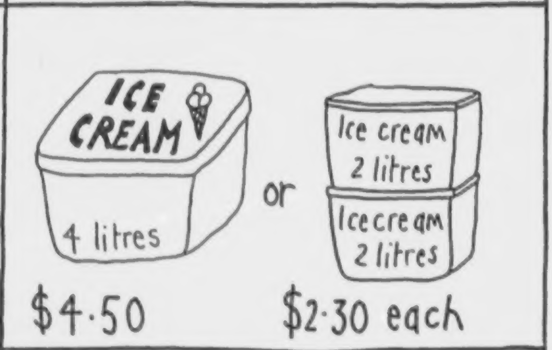

5 tins for $3
CAT FOOD
Cat Food
or
5 tins at 55c each

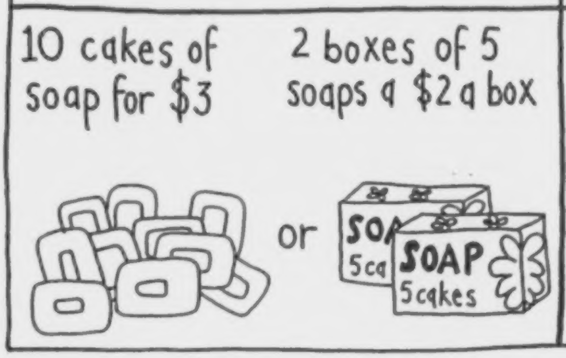

10 dinner rolls
25c each
or
$2·00
10 dinner rolls

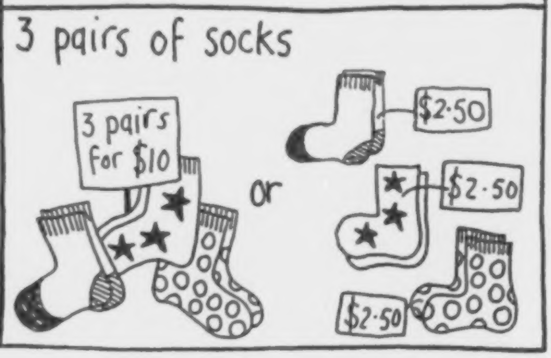

Fruit juice
2 litres
$2·99
or
1 litre
1 litre
$1·40 $1·40


3 kg oranges
3 kg
$1·49 a bag
or
50c kg


4 tubs of margarine
4 tubs for $5
or
$1·25 each


ICE CREAM
4 litres
$4·50
or
Ice cream 2 litres
Icecream 2 litres
$2·30 each


10 cakes of soap for $3
2 boxes of 5 soaps a $2 a box
or
SOAP 5cakes


3 pairs of socks
3 pairs for $10
or
$2·50
$2·50
$2·50

MULTIPLICATION AND DIVISION Worksheet 4

A pack of cards contains 52 cards.

1. How many cards each if you deal them out between 3 people?

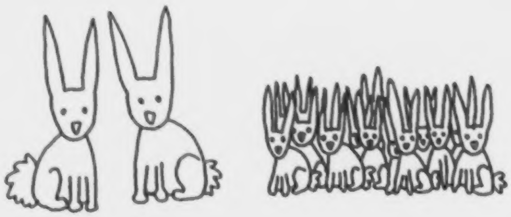
2. How many cards are there in each suit?
   (There are 4 suits: Hearts, Diamonds, Clubs, Spades).

3. If you take out the picture cards (Jack, Queen, King, Ace), how many cards does each person get when dealing out for 4 people?

Hint: use a pack of cards if you need help.

MULTIPLICATION AND DIVISION Worksheet 5

1. A family with pet rabbits buys 5 kilograms of carrots every 2 months to feed the rabbits. How many kilograms of carrots would they buy in a year?



2. A bike rider does 16km in an hour.
How many kilometres does she do travelling from 8.30am to 10.00am?

3. 5kg sack of walnuts cost $15.
How much is this for 1kg?

4. A car uses 30 litres of petrol to travel 300km.
How much does it use to do another 450km?

5. Mrs Lim must take 2 tablets twice a day.
How many does she need for a week?

MULTIPLICATION AND DIVISION Worksheet 6

1. Paper used by each person in a year

American	Australian	Indonesian
252kg	136kg	4kg

   (a) How many Indonesians use as much paper as one American?
   (b) How many Indonesians use as much paper as one Australian?

2. While you are sitting your heart is pumping about 5 litres of blood each minute.
   How much does it pump in 1 hour?

3. A bucket holds 10 litres.
   How many buckets of blood does a heart pump in 1 hour?

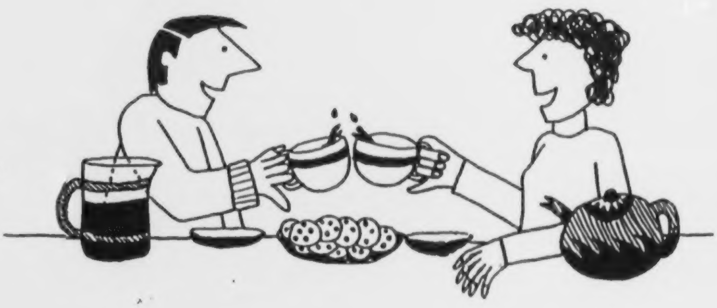
4. On average each Australian eats about 18 litres of icecream each year.
   How many 2 litre containers is this?

5. About how many weeks would each 2 litre container of icecream last?

6. For every death on the road, about 30 people are injured.
   If 5 were killed in a week, how many would be injured?

7. A woman drank 9 cups of tea each day.
   Her husband drank 4 cups of filter coffee.

   Who had the most caffeine?



(1 cup of filter coffee has the same caffeine as 3 cups of tea)

MULTIPLICATION AND DIVISION Answers

MULTIPLICATION WORKSHEET 1

1. 10 x 3 = 30 flies 2. 6 x 5 = $30 3. 5 x 5 = 25 km
4. 5 x 3 = $15 5. 3 x 2 = $6 6. 5 x 10 = 50 min
7. 5 x 20 = $100

MULTIPLICATION WORKSHEET 2

2 x 3 = 6 3 x 4 = 12
3 x 2= 6 4 x 3 = 12

2 x 6 = 12 3 x 6 = 18
6 x 2 = 12 6 x 3 = 18

2 x 4 = 8 3 x 4 = 12
4 x 2 = 8 4 x 3 = 12

2 x 2 = 4 1 x 3 = 3
2 x 2 = 4 3 x 1 = 3

MULTIPLICATION SKILLS WORKSHEET 1

1. (i) 63 (ii) 92 (iii) 600 2. 78 3. 852
4. (i) 154 (ii) 1705 (iii) 960 5. 1126 6. 756
7. 243 8. (i) 2375 (ii) 3252 (iii) 5562 (iv) 2124

DOUBLING WORKSHEET 1

1. 3 cups flour
4 tbspn. custard
1/2 cup sugar
1 cup rolled oats
250g butter
2 tbspn honey

2. $650
$1300

3. $1.74

4. 300 people

5. $1\frac{1}{2}$ hr.

6. $25

DIVISION SKILLS WORKSHEET 1

1. 16 2. $15 3. (i) 27 (ii) 107 (iii) 131 (iv) 12, 1 rem.
4. 16 5. $12\frac{1}{2}$ apples 6. 19 7. 52 8. 150

MULTIPLICATION AND DIVISION Answers

MULTIPLICATION AND DIVISION WORKSHEET 1

1. 10   2. $2.70   3. $520   4. 50 weeks   5. $700

MULTIPLICATION AND DIVISION WORKSHEET 2

1. $5.83   2. 1667 Kj   3. 2, and 2 left over   4. 1½ cakes

MULTIPLICATION AND DIVISION WORKSHEET 4

1. 14 cards   2. 13   3. 9 cards

MULTIPLICATION AND DIVISION WORKSHEET 5

1. 30 kg   2. 24 km   3. $3   4. 45L   5. 28 tablets

MULTIPLICATION AND DIVISION WORKSHEET 6

1. (a) 63 (b) 34   2. 300L   3. 30 buckets
4. 9 containers   5. 6 weeks   6. 150 injured
7. the husband

▸ MONEY AND METRICS ◂

MONEY AND METRICS
Introductory Notes

Money and Metrics are the principle areas where decimals occur in everyday life. In fact they are the main reason for adults needing to learn about decimals. In this section, decimals are treated entirely in the context of everyday situations and no formal treatment is given to tenths or hundredths. To be numerically confident, adults need to be able to handle money. We therefore include a variety of money centred activities.

Most calculations performed by adults in their daily life are estimations done without pen and paper. Therefore the first two sessions are designed for students to gain confidence and practice in this important skill. (There are also more general activities involving estimation in the sessions *How Much Do We Know About Each Other* and *Estimating Time* in the section *Getting Started).*

Eight sessions are included here.

Practising Estimation Skills allows students to work with a partner to make reasoned approximations to general knowledge questions.

Estimating Money Calculations uses supermarket dockets to give the students a source of numbers for approximating totals.

Shopping includes many types of money calculations to be done with, or without, a calculator.

Change is a session using 'counting on' as a method for checking change.

Mental Calculations provides many quick calculations which could be done without pen and paper, or calculator. This includes simple additions and subtractions with money as well as calculations with time and metric measurements.

We focus particularly on the use of the Calculator with money in *Calculator and Money* because adults are often unsure of the decimal format.

Metric Activities contains many practical suggestions for improving knowledge and confidence when using metric measurements.

Metric Worksheets consists of worksheets involving metric units in calculations.

PRACTISING ESTIMATION SKILLS

Skills Developed

- Estimation
- Social Interaction
- Use of metric units

Materials

- Worksheet 1

This session encourages students to "think metric" and to discuss a range of questions using the language of time and the metric system. The questions provided cover many aspects of time and measurement and are of varying degrees of difficulty.

PREPARATION

Paste Worksheet 1 on to card and cut out individual questions. Select those which are appropriate to your group or make up some cards of your own with questions specifically relevant to your students.
Place these in a bowl, box or 'hat'.

SESSION OUTLINE

Ask a student to pick a card at random. Group students in twos or threes to discuss the question on the card and decide on an answer. The answers from each group should then be discussed by the whole class, reasons being given for the estimations.

Explain that although students may feel that they can't answer a question, they are likely to have *some* information which will help them arrive at a figure near the answer. This reasoning process is an important part of the exercise.

eg. *What is the height of the ceiling?*

One group may know that the door is 2 metres high and there is about 1 metre above the door, giving a total of 3 metres.

Another group may know that a person is just under 2 metres tall and estimate that one person would fit approximately one and a half times from floor to ceiling.

If groups arrive at different approximations, the class should then decide how the answers could be checked to see which estimation is closest to the actual answer.

After three different cards have been used, discuss the use of estimation briefly, asking

> *Is an estimate good enough or do you need exact measurements when buying clothes or shoes, for example?*
>
> *Can you think of instances when you estimate a quantity?*
>
> *Can you think of situations when you have to be accurate?*

PRACTISING ESTIMATION SKILLS Worksheet 1

Make these into small cards by pasting on cardboard and cutting them out.

How many bananas in 2kg?	How long will it take to travel to Ballarat by car?
How many days until Christmas?	How long does the sun shine on a summer's day?
How far is it to Sydney?	What could you buy if you were given $1000?
How many metres of material do you need to make a tracksuit?	What is the length of this room?
How many people could you seat in this room for a class?	How many litres of water are used in a 10 minute shower?
What could you buy with a $100 prize?	How heavy is a bucket of water?
How many minutes will it take to walk 1 kilometre?	How much does it cost to fly to Sydney?

ESTIMATING MONEY CALCULATIONS

Skills Developed

- Rounding off with money
- Estimation
- Addition of money
- Calculator use with money

Materials

- Worksheet 1
- Cash Register dockets without totals
- Calculator
- Sales catalogues or cards from *'Change'* session

When shopping at the supermarket or buying lunch at the canteen we often estimate the amount it will cost so that we don't have the embarrassment of not being able to pay. It is a skill which many of us take for granted but it could usefully be taught and practiced in the numeracy class.

PREPARATION

Collect a number of cash register dockets of various types - the students could help with this. Cut off the total amount in each case.

SESSION OUTLINE

1. Ask if anyone estimates the total cost when shopping at a supermarket or when eating out. The students could explain how they do it.

   Now go through a typical example of a shopping estimation:

   I have $20. Could I buy a shirt for $8.95 and shorts for $10.70?

   Explain that you don't have to do any exact calculation. Initially it will do to say to yourself.

   $8.95 is a bit less than $9.
   $10.70 is a bit less than $11.
   And $9 plus $11 is $20.
   So the exact total will be less than $20 and I can buy them.

2. For some gradual practice at rounding off go through the following with the class.

   Give students a number of prices - either use the cards from the session *Change* in this section or use catalogues. Ask them what are the easiest number to change them to for quick calculations.

   eg. $9.95 make into $10.00
   $1.75 make into $1.80 or $2.00
   $3.10 make into $3
   85c make into $1 or 90c
   $299 make into $300

Note At the time of writing, the Australian government was announcing the abolition of 1c and 2c coins. For this reason we have omitted examples using such prices as $2.99, $5.98 from our lists. If it is still appropriate, many such examples should be used.

Students can now do the Worksheet. After estimating the totals they should use a calculator to find exact totals.

3. Continue practising these skils using actual cash register dockets. Estimate first, use the calculator afterwards.

As a group try discussing possible shopping situations such as:

> *Imagine that you do not have enough money to pay.*
> *What would you put back?*

Use one of your cash register dockets to illustrate.

eg. *Total is $38.65 and you only have $35. Your total is about $4 over and so look for an amount on the docket which is about $4, which you can remove.*

Students may have stories to share about this type of situation. They should be encouraged to discuss how they avoid such things happening to them and ideas for keeping running totals in the supermarket. This is especially difficult with new trends of not labelling the actual goods. (It would probably be good for them to hear that not having enough to pay is something that happens sometimes to you, the teacher, as well!)

CALCULATOR AND MONEY

Worksheet 1

Estimate the totals

Yoghurt	2.60
Bread	1.65
Milk	.90
Batteries	3.30

Hamburger	2.25
Chips	1.10
Drink	.85

Cask of wine	7.95
Champagne	5.95

Electricity Bill	189.70
Phone Bill	123.07

1 pair of shoes	$45
1 pair of laces	$ 4
1 pair of thongs	$ 9.95

3 metres of material at $5.95 a metre

2 metres of material at $6.95 a metre

SHOPPING

Pre-skills

- Addition and subtraction of money

Skills Developed

- Addition and subtraction of money.

Materials

- Worksheets 1-5
- Calculator

This session provides addition and subtraction exercises connected with common items of shopping, to give students more confidence doing calculations with money.

SESSION OUTLINE

The worksheets are designed for individual practice with money calculations.

Worksheets 1 and 2 have prices easy enough to be used without a calculator. In these times of inflation prices will quickly become outdated. Worksheets 3, 4 and 5 have blanks to be filled with current prices.

These prices could be:

- Filled in by you.
- Filled in during class after discussion.
- Filled in by students after a visit to the shops.
- changed to provide additional exercises.

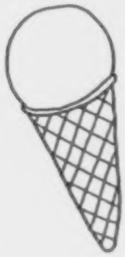
A calculator may be needed for Worksheets 3-5 as prices will not be so easy for calculations.

Another suggestion

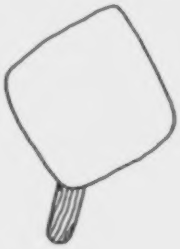
Use a menu from a restaurant or home delivery menu to provide more exercises.

SHOPPING

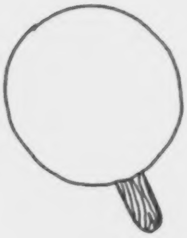
Worksheet 1



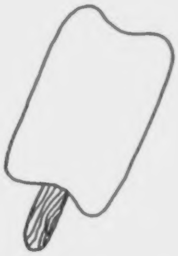
Cone
70c



Ice of Diamonds
65c



Round Ice
$1·10



Chocolong
95c

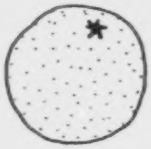
What change will I get from $2 if I buy:

1. 1 Cone
2. 1 Chocolong
3. 1 Ice of Diamonds
4. 1 Round Ice
5. 2 Cones
6. 2 Chocolongs
7. 2 Ice of Diamonds
8. 1 Round Ice & 1 Cone
9. 1 Chocolong & 1 Ice of Diamonds
10. 1 Ice of Diamonds & 1 Cone

SHOPPING

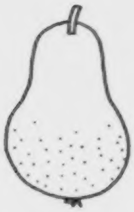
Worksheet 2

Banana
60^c



Orange
40^c

Apple
65^c



Pear
35^c

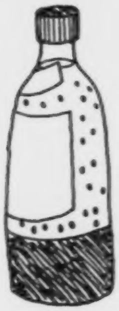
How much will it cost to buy:

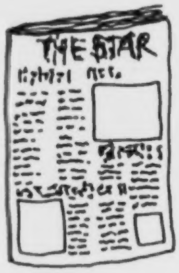
1. 1 banana & 1 apple
2. 2 apples
3. 1 apple & 1 pear
4. 1 orange & 1 banana
5. 2 pears
6. 2 pears & 1 orange
7. 2 oranges & 1 banana
8. 1 banana, 1 apple, 1 pear
9. 1 of each fruit
10. 2 bananas

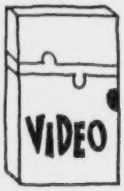
SHOPPING

Worksheet 3

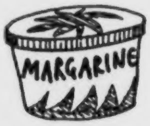
Fill in up to date prices

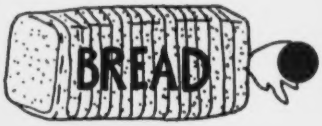




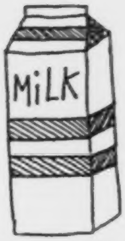


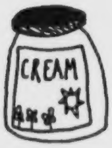
Video

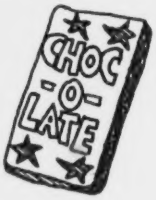




Bread







You have $__________
You buy a newspaper __________
loaf of bread __________

TOTAL __________

Change __________

You have $__________
You pay for a video __________
a chocolate __________

TOTAL __________

Change __________

You have $__________
You pay for margarine __________
bottle of mineral water __________
1 litre of milk __________

TOTAL __________

Change __________

You have $ __________
You pay for a newspaper __________
bottle of cream __________
a video __________

TOTAL __________

Change __________

SHOPPING **Worksheet 4**

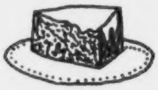
DRINKS

Can of Drink $1·15

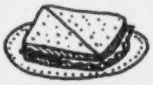
Coffee $1·00

Pot of Tea $1·10

SNACKS



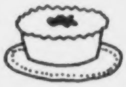
Carrot Cake $1·15



Sandwich $2·25

HOT FOOD

Chips $1·30



Pie $1·20

ORDER 1 1 coffee 1 carrot cake TOTAL ________	ORDER 2 1 can of drink 1 chips 1 pie TOTAL ________	ORDER 3 1 pot of tea 1 sandwich TOTAL ________
ORDER 4 2 coffees 2 sandwiches TOTAL ________	ORDER 5 1 can of drink 1 carrot cake TOTAL ________	

How many dollars would you give to pay for each order.
How much change do you get?

	ORDER 1	ORDER 2	ORDER 3	ORDER 4	ORDER 5
Amount given					
Total					
Change					

What could you get for $3?

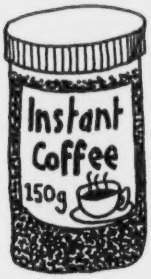
1991 Strength in Numbers: Goddard, Marr, Martin

SHOPPING

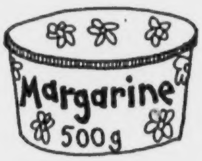
Worksheet 5

1976 PRICES

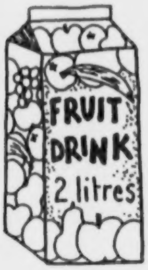
TODAY'S PRICE ....
1976 PRICE $1.39
PRICE INCREASE ....


Instant
Coffee
150g

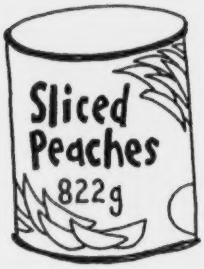
TODAY'S PRICE ....
1976 PRICE 59c
PRICE INCREASE ....


Margarine
500g

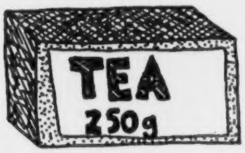
TODAY'S PRICE ....
1976 PRICE 49c
PRICE INCREASE ....


FRUIT
DRINK
2 litres

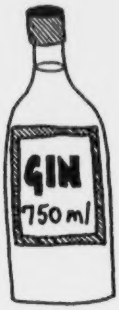
TODAY'S PRICE ....
1976 PRICE 49c
PRICE INCREASE ....


Sliced
Peaches
822g

TODAY'S PRICE ....
1976 PRICE 43c
PRICE INCREASE ....



TODAY'S PRICE ....
1976 PRICE $5.75
PRICE INCREASE ....



CHANGE

Skills Developed
- Familiarity with money
- 'Counting on' method of giving and checking change.

Materials
- Cards prepared using sales catalogues
- Real money (coins)
- Play money (notes)

This session gives practice in counting out money and calculating change by the method of 'counting-on'. This is a practical method used by shopkeepers to eliminate the need for subtraction and assure the customer that they are receiving the correct change.

Counting-on can be very useful for students who have difficulty learning how to subtract.

PREPARATION

From sales catalogues (junk mail) or menus cut out a number of **single items** including a picture of the item, and its price, on small cards.

For interest include a variety of items and a range of prices:
- whole dollars eg. $6, $25
- dollar amounts with 99c or 95c eg. $2.99, $6.95
- dollars and 50c, 60c etc. eg. $8.50, $13.20
- amounts less than $1 eg. 73c, 29c

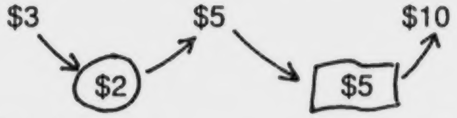
SESSION OUTLINE

The activities are arranged in order of difficulty. All should be done by simulation with money and **not** using calculators or pens and paper. You and the students should act out the roles described.

Activity 1 - Counting On with Whole Dollars

Use money and cards with whole dollar prices to demonstrate 'counting on'.

eg. Customer (a student) buys socks worth $3 and pays with a $10 note.
Shop assistant (you) count back the change saying as you give money
$3 and $2 make $5 and $5 make $10.
Record this on the board like this



It is usually easier to work through from smaller coins or notes to higher value ones.

Students can practise in pairs.
Each member of the pair takes it in turns to be customer or shop assistant. Nothing should be written down, concentrate instead on counting out loud using money.
After the person acting as shop assistant has given change the customer should check it by repeating the counting process. (If the amounts are easy they could be checked by adding, otherwise counting on again would be a better way.)

eg. *$3 plus $7 change makes $10.*

Activity 2 - Approximating Change

Ask a question of the group such as:

> *I have $10 in my purse and want to buy 3 bottles of wine costing $2.95 each. Can I buy them?*
> *Would you do the calculations with $2.95 or would you use an easier number?*

Use prepared cards with item prices suitable for rounding. With the group first go through the cards you have prepared and ask:
What whole number of dollars is this amount closest to?

eg. $2.95 is closest to $3
75c is near 80c
$1.65 is near $1.70

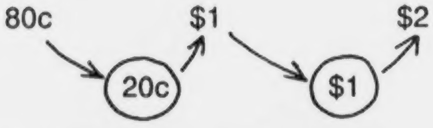
From this exercise you now have easier numbers to work with and have only changed the amounts slightly.

Now introduce 'counting on' from this easier number. Go through the following examples using only 'counting on'. At this stage the actual value of the change is not important, instead it should be possible to count from the item price to the amount tendered. See examples following.

Example 1 *A customer buys a $5.95 pot plant and gives the shop assistant $10 and wants to know the approximate change.*
$5.95 is close to $6.
$6 and $4 more makes $10
So the change is approximately $4.

Example 2 *Customer gives $2 to buy a 75c chocolate bar. What is the approximate change.*

75c is nearly 80c
80c and 20c more make $1
and another $1 makes $2



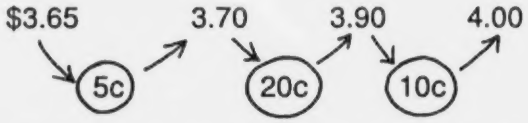
The change is roughly $1.20

Give students further practice in calculating approximate change (by **rounding off** and **counting on**) using the prepared cards.

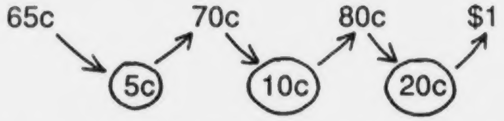
Activity 3 - Counting On to Give the Exact Change

In the following examples **exact** change is given by 'counting on'.

Example 1 *A magazine costs $3.65. The customer tenders $4. What change will she get?*



Example 2 *A pencil costs 65c. What change will there be from $1?*



Divide students into pairs - one as customer, the other as shop assistant - and give them some money and cards.

The customer picks up a card and 'buys' one item, giving the shop assistant an amount of money which will require change.

The customer uses rounding off to work out **approximate** change. The shopkeeper counts on with actual money to give the **exact** change. Reverse roles and try another item.

Extensions

1. Use the cards and take away menus or catalogues to buy more than one item. Do the calculations mentally using rounded off amounts and calculate the change.

2. A real shopping trip or a visit to a cafe by the group, each paying individually and checking their change.

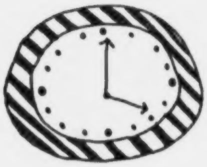
MENTAL CALCULATIONS OR QUICK QUESTIONS

Skills Developed

- Mental calculations with money, time and metrics

Materials

- Worksheets 1, 2, 3, 4



Most calculations done by adults are done without pen or paper. This session provides a number of exercises grouped to give practice with some everyday types of calculation involving money, time and metric measurement.

PREPARATION

Cut worksheet into groups of 10.
For repeated use, paste each group of 10 onto cardboard and put the answers on the back for self checking.

SESSION OUTLINE

Encourage students to do these calculations in their heads as the calculations are simple enough to be done without calculators or setting figures out in columns.

The session consists of calculations which can be presented in a number of ways:

1. In class give each student ten questions at a time to do during a session.
2. Write each question on a card and keep them in groups of ten so students can go through them in spare moments.
3. As a learning exercise repeat the questions until the student is quite familiar with the answers.
4. Students could work in pairs asking each other the questions and not writing anything down. Answers are on the back of the worksheet for instant checking.

QUICK QUESTIONS

Worksheet 1

A. How much more do you need to make $1?

1. 60c
2. 30c
3. 50c
4. 90c
5. 40c

How much more do you need to make $2?

6. $1.25
7. 80c
8. $1.30
9. $1.05
10. 85c

B. Write the answer to these:

1. $1.60 + 40c
2. 70c + $3.30
3. $4.50 + 50c
4. $2.75 + 25c
5. 65c + 35c
6. $6.90 + 10c
7. $19.95 + 5c
8. $3.50 + $4.50
9. $3.20 + 80c
10. $8.40 + 60c

C. How much money left?

1. $5 - 50c
2. $3 - 5c
3. $6 - 5c
4. $10 - 5c
5. $6 - 60c
6. $20 - 50c
7. $2 - 25c
8. $8 - 50c
9. $10 - 10c
10. $9 - 5c

QUICK QUESTIONS Worksheet 2

A.
1. How many 20c coins make $1
2. How many 50c coins make $4
3. How many $5 coins make $20
4. How many 20c coins make $1.40
5. How many $2 coins make $20
6. How many 10c coins make $3
7. How many 5c coins make 30c
8. How many 5c coins make 50c
9. How many 50c coins make $10
10. How many $2 coins make $30

B. What is the value of:
1. six 20c coins
2. five 50c coins
3. four $5 notes
4. eight $20 notes
5. twelve 5c coins
6. four 5c coins
7. nine $2 coins
8. ten 50c coins
9. three $20 notes
10. seven 10c coins

C.
1. $10 - $1.50
2. $10 - $3.50
3. $10 - $2.50
4. $5 - $1.50
5. $5 - $2.50
6. $5 - $3.60
7. $20 - $2.50
8. $20 - $10.50
9. $20 - $5.50
10. $20 - $11.50

QUICK QUESTIONS

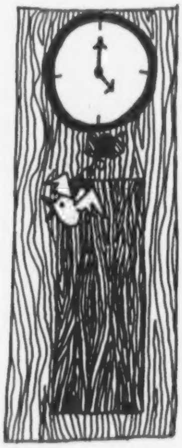
Worksheet 3

A. What is half of each of these times?

1. 10 min
2. 1 min
3. 30 min
4. 25 min
5. 12 hours
6. 1 year
7. a fortnight
8. 5 hours
9. 1 and a half hours
10. 2 hours 40 min

B. Find a quarter of each of these:

1. 1 year (in months)
2. 1 day (in hours)
3. 1 hour (in minutes)
4. 6 hours
5. 1 minute (in seconds)
6. 2 hours
7. 1 hour 20 minutes
8. 40 cents
9. $20
10. 1 kg



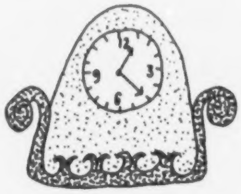
C. Double these:

1. 10 minutes
2. 25 minutes
3. quarter of an hour
4. half hour
5. 40 minutes
6. 12 hours
7. 1 kg (in grams)
8. $1 (in cents)
9. $3 (in cents)
10. 1 litre (in millilitres)

QUICK QUESTIONS Worksheet 4

A. Find the missing number.

1. 250g and ___ makes 1kg
2. 150g less than 1kg is ___
3. 1kg minus 650g leaves ___
4. 350g plus ___ equal 1kg
5. subtract 125g from 1kg
6. 400ml added to 600ml is ___
7. 1 litre less 300ml is ___
8. take 750ml from 1 litre
9. add ___ to 500ml to make 1 litre
10. subtract 700ml from 1 litre



B. What is the next hour?
How many minutes until the next hour?

1. 1.30 am
2. 2.15 pm
3. 3.40 pm
4. 10.25 am
5. 12.55 am
6. 9.22 am
7. 5.46 am
8. 7.55 am
9. 6.35 pm
10. 4.58 am

QUICK QUESTIONS

Worksheet 4
(Continued)

C. Add 5 cents to each of these:

1. $2.95
2. $15.95
3. $37.95
4. $10.95
5. $29.95
6. $74.95
7. $30.95
8. $110.95
9. $11.95
10. $51.95

CALCULATOR and MONEY

Skills Developed

- Using the calculator for addition, subtraction, multiplication and division of money.
- Interpreting answers on a calculator display.

Materials

- A calculator for each student or pair

In this session we use the calculator for calculations with money. Many students are uncertain and worried about using a calculator especially with money because of the decimal format of dollars and cents.

SESSION OUTLINE

Before doing some money calculations, the following aspects of calculator use may need clarifying with your students:

1. Operation Symbols

ie. the buttons + - X ÷ =

Ask students to add 17 and 22 on their calculators.

ie. press 1 7 + 2 2 =

The answer will then appear on the display.

Now

- To examine the role of the = button, ask students to enter only

1 7 + 2 2

The number 22 will remain on the display.

Point for discussion:

Pressing the = button instructs the calculator to work out the answer and display it.

If the = button is *not* pressed, the calculation is *not* carried out and the final entry, ie. 22, remains on the display.

- To examine the role of the + button, ask students to enter

1 7 2 2 =

The number 1722 will appear on the display.

Point for discussion:

Pressing the $\boxed{+}$ button is essential. Without it, the calculator interprets this as the number 1722. Then when the $\boxed{=}$ button is pressed, it has no meaning and it activates nothing. 1722 remains on the display.

The same applies to the $\boxed{-}\boxed{\times}\boxed{\div}$ buttons.

2. Display of Money

Dollars and cents need to be displayed in decimal format on a calculator.

- Ask students to enter $1.95 on their calculator.

  $\boxed{1}\boxed{.}\boxed{9}\boxed{5}$

  Point for discussion:
  The decimal point separates the dollars from the cents.

- Now ask students to enter 63c.

  Point for discussion:
  How does the calculator know if it's 63 dollars or 63 cents?

  It is necesssary to put in a **decimal point**

  $\boxed{.}\boxed{6}\boxed{3}$

  to tell the calculator it is 63 cents.

- Now ask students to enter 7c.

  Point for discussion:
  This must be entered as

  $\boxed{.}\boxed{0}\boxed{7}$

  to distinguish 7c from 70c.

3. Clearing

Calculators have two clearing functions, for which the relevant keys may vary from one calculator to another:

(i) to clear only the **last number** entered,

keys $\boxed{\text{CE}}$ or $\boxed{\text{CE/C}}$ or $\boxed{\text{CI}}$ pressed once.

(ii) to clear **everything**

keys CA or C pressed once
or CE/C or CI pressed twice.

Students will need to clarify which of these buttons their own calculators have.

To do this, and to demonstrate the clearing functions, work through the following examples with your students.

(i) Ask students to add $1.95 and 63c but suggest in doing so they make an error in entering the 63c by leaving out the decimal point

enter 1 . 9 5 + 6 3

Having realised the error, you want to cancel the 63. You do this by pressing

CE or CE/C or CI

Point for discussion:

Pressing the CE button will clear the last number entered.
ie. 63 will go but 1.90 + will remain.

Now you can re-enter the correct number.

. 6 3

and complete the calcuation by pressing =

(ii) Again ask students to do the addition $1.95 + 63c.

enter 1 . 9 5 + . 6 3

But now suggest you have changed your mind and you want the students to clear the whole sum.

They can do this by

pressing CA or C once

or

pressing CE/C or CI twice

Point for discussion:
What has happended?
The display will now show 0.
If the $\boxed{=}$ button is pressed, the display will still show 0.
ie. everything that had been entered into the calculator has been cancelled.

- Is it necessary to clear between calculations?
  To investigate this with your students, consider the two additions.

17 + 22
and 35 + 8

Ask students to

(i) Clear between each addition

$\boxed{1}\boxed{7}\quad\boxed{+}\quad\boxed{2}\boxed{2}\quad\boxed{=}$

record answer from display

$\boxed{C}$

$\boxed{3}\boxed{5}\quad\boxed{+}\quad\boxed{8}\quad\boxed{=}$

record answer from display.

(ii)**not** clear between additions

$\boxed{1}\boxed{7}\quad\boxed{+}\quad\boxed{2}\boxed{2}\quad\boxed{=}$

record answer

$\boxed{3}\boxed{5}\quad\boxed{+}\quad\boxed{8}\quad\boxed{=}$

record answer

Point for discussion:

Do the two sets of answers differ?
No.
So calculator automatically clears when another number is entered after the $\boxed{=}$ button has been pressed.

However, some people like to start with a clear display, just to "be sure", and will always press $\boxed{C}$ before starting a new calculation.

Now students can use their calculators to tackle some money problems.

1. Addition

Write the amounts $1.90, 63c, 7c and $3 on the board.

Discuss with students what you would roughly expect the total of these monies to be.

ie. approximate an answer by saying:

$1.90 is roughly $2.00
63c and 7c are roughly another dollar
and 3 more dollars makes $6.

Discuss with students the value in having an idea of a "reasonable" answer when working with a calculator. Otherwise, how can you know if you've made a mistake - easy enough to do when pressing buttons.

Now ask students to find the total on their calculators.

Is the answer reasonable compared to the rough estimate?

2. A Total and the Change

Ask students to find the total of $3.89, $16, $1.99 and find the change they would receive from $25.
(Note: remind students to find a rough answer first).

There are three possible methods.

(i) Using pencil and paper as well as calculator:

- Find the total on the calculator

$\boxed{3}\boxed{.}\boxed{8}\boxed{9}\quad\boxed{+}\quad\boxed{1}\boxed{6}\quad\boxed{+}\quad\boxed{1}\boxed{.}\boxed{9}\boxed{9}\quad\boxed{=}$

- Write down the total that appears on the display ie. 21.88

- Use the calculator to subtract the total from the $25.

$\boxed{2}\boxed{5}\quad\boxed{-}\quad\boxed{2}\boxed{1}\boxed{.}\boxed{8}\boxed{8}\quad\boxed{=}$

(ii) Using the **memory function** on the calculator. This avoids the necessity of using pencil and paper to record part of the working as you go.

- Enter $25.00

$\boxed{2}\boxed{5}$

- Store it in memory

$\boxed{M+}$

(Note: 25 will still be showing on the display but 25 is also safely recorded in memory, so that the display can now be used for further calculations).

- Find the total

$\boxed{3}\boxed{.}\boxed{8}\boxed{9} \quad \boxed{+} \quad \boxed{1}\boxed{6} \quad \boxed{+} \quad \boxed{1}\boxed{.}\boxed{9}\boxed{9} \quad \boxed{=}$

- Subtract this total from the 25 stored in memory.

$\boxed{M-}$

- Recall the answer from memory and show it on the display.

$\boxed{RM}$

The answer will now be on the display.

(iii) Another way to use memory.

- Find the total

$\boxed{3}\boxed{.}\boxed{8}\boxed{9} \quad \boxed{+} \quad \boxed{1}\boxed{6} \quad \boxed{+} \quad \boxed{1}\boxed{.}\boxed{9}\boxed{9} \quad \boxed{=}$

- Store it in memory.

$\boxed{M+}$

- Enter $25 on the display

$\boxed{2}\boxed{5}$

- Subtract the total in memory from the 25 on the display.

$\boxed{-}\ \boxed{RM}\ \boxed{=}$

The answer will now be on the display.

3. Multiplication

Ask students to find the total cost of 8 icecreams at 85c each.
Remind them to have an idea of a rough answer before they use their calculators.

After doing the multiplication, ask students to multiply the numbers the other way around.

$\boxed{8}\ \boxed{\times}\ \boxed{8}\boxed{5}\ \boxed{=}$

$\boxed{8}\boxed{5}\ \boxed{\times}\ \boxed{8}\ \boxed{=}$

Does the order matter?

4. Multiplication and Addition

(i) Ask the students to work out the total cost of 2 pizzas at $11.90 each and 1 garlic bread at $1.80.

$\boxed{2}\ \boxed{\times}\ \boxed{1}\boxed{1}\boxed{.}\boxed{9}\boxed{0}\ \boxed{+}\ \boxed{1}\boxed{.}\boxed{8}\boxed{0}\ \boxed{=}$

What happens if you start with the garlic bread?

$\boxed{1}\boxed{.}\boxed{8}\boxed{0}\ \boxed{+}\ \boxed{2}\ \boxed{\times}\ \boxed{1}\boxed{1}\boxed{.}\boxed{9}\boxed{0}\ \boxed{=}$

Some calculators will give the same answer both times, but most will not.

Doing the calculations the second way will be interpreted by most calculators as:(1.80 + 2) all multiplied by 11.90.

With these calculators, it is necessary to use the memory to get the correct answer. This is the method:

- Enter 1.80

$\boxed{1}\boxed{.}\boxed{8}\boxed{0}$

- Store it in memory

$\boxed{M+}$

- Find the cost of 2 pizzas

$\boxed{2}\quad\boxed{x}\quad\boxed{1}\boxed{1}\boxed{.}\boxed{9}\boxed{0}\quad\boxed{=}$

- Add the 1.80 from memory to this

$\boxed{+}\quad\boxed{\text{RM}}\quad\boxed{=}$

The answer will now be on the display.

In this example it is possible to avoid using the memory by doing the calculations in a different order, ie. pizzas first.

However, in more complicated examples this is not the case. Here is such an example, where the use of memory is necessary.

(ii) Ask students to work out the total cost of

2 pizzas at $11.90
1 garlic bread at $1.80
3 mineral waters at $1.20
3 coffees at $1.50

In this example the memory is used to keep a running total.

- Find total cost of pizzas

$\boxed{2}\quad\boxed{x}\quad\boxed{1}\boxed{1}\boxed{.}\boxed{9}\boxed{0}\quad\boxed{=}$

- Store this total in memory

$\boxed{\text{M+}}$

- Enter cost of garlic bread

$\boxed{1}\boxed{.}\boxed{8}\boxed{0}$

- Add this to cost of pizzas in memory

$\boxed{\text{M+}}$

- Find total cost of mineral waters

$\boxed{3}\quad\boxed{x}\quad\boxed{1}\boxed{.}\boxed{2}\boxed{0}\quad\boxed{=}$

- Add this to running total in memory

  $\boxed{M+}$

- Find total cost of coffees

  $\boxed{3}\ \boxed{x}\ \boxed{1}\boxed{.}\boxed{5}\boxed{0}\ \boxed{=}$

- Add this to running total in memory

  $\boxed{M+}$

- Recall memory to get final answer

  $\boxed{RM}$

The answer will now be on the display

Students can now do **Worksheet 1.**

5. Division

(i) A bag of 6 rolls cost $2.10

Ask students to use their calculators to find out how much one roll will cost.

$\boxed{2}\boxed{.}\boxed{1}\boxed{0}\ \boxed{\div}\ \boxed{6}\ \boxed{=}$

The answer of 35c will now be on the display.

What happens if 6 is put in first? Try it.

Note: If students are confused about the order of the numbers in division, spend some time going back over the session *Concept of Division.*

In this example the answer to the division worked out exactly. However, this is often not the case with division, and the resulting numbers on the display can be very confusing. The next 2 examples look at such cases.

(ii) A packet of 2 pens costs $3.15.
How much does each pen cost?

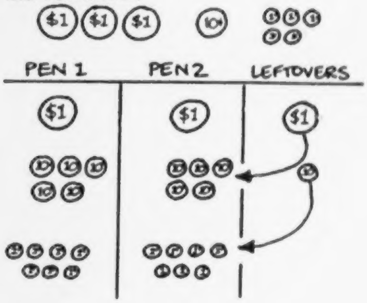
Using the calculator

$\boxed{3}\boxed{.}\boxed{1}\boxed{5}\ \boxed{\div}\ \boxed{2}\ \boxed{=}$

results in the display showing 1.575
What does this mean?

The students may like an explanation of why the calculator gives this answer.

To do so, model this solution by using 10c and 1c coins as follows:



First you have $3.15 to share between two pens

Beginning with the single dollars share between two pens

The leftover dollar can be changed to ten ⑩ coins, altogether 11 to be shared

The leftover ⑩ coin is changed to ten ① coins, now altogether 15 ① to share

We have ① left, we know there is no smaller coin so we stop, but the calculator doesn't. It keeps going, changing into ten and sharing: 5 to each pen.

Discuss: If you bought one pen what would you pay?

(iii) Discuss this situation with your students:

Three friends go out to coffee and the total bill comes to $10.

They agree to share it equally, and one friend uses her calculator to work it out.

$\boxed{1}\boxed{0}\ \boxed{\div}\ \boxed{3}\ \boxed{=}$

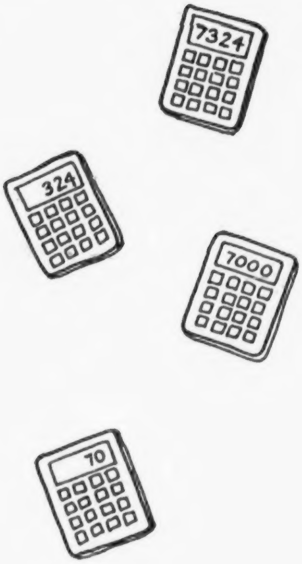
The display shows 3.333333

If each person pays $3.33, does this pay the bill?
No, they are 1 cent short because $10 cannot be exactly shared between 3. (Illustrate this by asking students to multiply 3.33 by 3 and see what happens.)

Discuss with students a reasonable solution to this dilemma, ie. one person pays 1c more!

Students can now do **Worksheet 2.** 213

Final Notes About Using A Calculator



1. Is the answer correct?

Students may feel that calculators are mysterious and sometimes make mistakes. Most mistakes are human errors and students will become aware of the type of mistakes they make after they use the calculator for a while.
(Calculator mistakes usually only happen when the batteries are running low and this doesn't happen very often.)

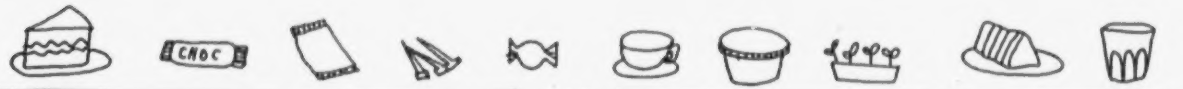
Ways of checking the answer:
- Have an idea of the approximate answer by rounding off (see Session *Estimating Money Calculations*)
- Repeat the calculation
- Have a "feel" for the right size of the answer.

2. Should we be using calculators?

Calculator use is now advocated at all levels of school and many jobs expect calculators to be used. Students should learn how to be proficient with a calculator and *then* decide whether they want to use it instead of relying on pen and paper.
For a longer discussion about using calculators see Session *What is Your Measure* in *Getting Started* section.

For further work with calculators, see *Maths: A New Beginning.*

CALCULATOR AND MONEY — Worksheet 1



1 packet of chips	90c
1 chocolate bar	85c
1 cake	$1.10
TOTAL	
Change from $3	

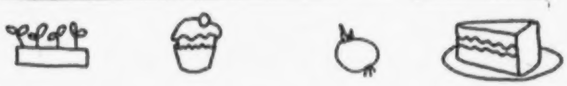
margarine	1·57
drink	·99
tracksuit pants	20·00
TOTAL	
Change from $25	

3 pizzas at	7.90 each
1 lasagne at	5.90
Find the total cost	

4 coffees at	$1.20 each
3 sandwiches at	$2.35 each
1 pie for	$1.10
Total cost	

1 hammer	16.70
1 packet nails	3. 15
1 packet batteries	5·85
TOTAL COST	

1 plant	6·85
2 packets of seeds	2·95 each
2 punnets of seedlings	3·15 each
TOTAL	



1991 Strength in Numbers: Goddard, Marr, Martin

CALCULATOR AND MONEY Worksheet 2

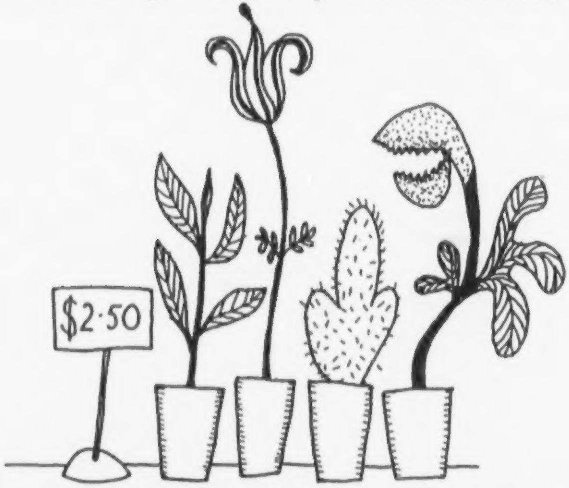
A. Write the answer in dollars and cents. eg. 1.5 = $1.50

1. $4 ÷ 20
2. $6 ÷ 5
3. $52 ÷ 8
4. $16.40 ÷ 8
5. $340 ÷ 25
6. $1.30 ÷ 26
7. $9 ÷ 15
8. $80.40 ÷ 8
9. $125 ÷ 50
10. $6 ÷ 100

B. Work these out using the calculator and then write the answer in dollars and cents.

1. $100 ÷ 6
2. $150 ÷ 8
3. $35 ÷ 6
4. $104 ÷ 3
5. $125 ÷ 52
6. $64 ÷ 12
7. $4000 ÷ 365
8. $120 ÷ 36
9. $61 ÷ 12
10. $98.50 ÷ 12

C.
1. Special: 4 for $7. How much each?
2. Divide $20 bill between 8 flatmates.
3. How many $2.50 plants can I buy with $20?
4. It costs $15 to buy 6 glasses. How much does each one cost?
5. Share $1000 prize money between 6 workmates.



METRIC ACTIVITIES - THE METRE

Skills Developed

- Estimation
- Practical use of fractions of a metre
- Measuring by pace

Materials

- Contact, 1 metre roll cut into 2cm wide strips
- Marker pen
- A long tape (eg. builders tape) or trundle wheel
- A tape measure

This session is designed to familiarise students with lengths expressed in metres.

Activity 1 examines commonly used fractions of a metre and develops simple fraction concepts.

Activity 2 suggests strategies for estimating distances between 0 and 100 metres.

You may wish to do the activities at separate times rather than having a whole session on metric length only.

SESSION OUTLINE

Activity 1 Making Your Own Metre Tape

- Leave the backing on the Contact and give each student a metre long strip.

  Ask them to find some measures which are about 1 metre. eg. waist to the ground, fingertip of outstretched arm to opposite shoulder, wheelchair handles to the ground.

- Hold the tape alongside the Contact strip and ask students if they know what the numbers mean and where is a metre. (100 centimetres is the same as 1 metre).

Now ask students to:

- Fold the Contact strip in half. Label as shown in the diagram. Also, fold the tape in half to show that 1/2 metre is 50cm.
- Find some objects which are about 50cm (or 1/2 m) long.
- Fold the strip again to give quarters and label the next section as shown. Fold the tape to show 1/4 m is 25cm.
- Ask students to find some objects which are 25cm (or 1/4 metre) long.
- You could extend this to ask what the other fold represents in centimetres (75cm).
- A metre strip could be left attached to the wall for reference, labelled as shown in the diagram.

Extensions

1. Is your pace close to 1 metre? Use the metre strip to check this - most will be less than 1 metre.
2. If you have a trundle wheel you could demonstrate how it works by laying a metre strip on the ground and making one revolution or wrapping the tape around the trundle wheel. As a short activity students could then measure the length and width of the room.

Activity 2 Estimating Distances In Metres

- Go outside or find a hall or corridor and ask students to guess which object is 10 metres away. (It maybe necessary to prepare this before hand by moving objects or measuring it out yourself).

- Ask the students how they could check the guess or guesses. (Apart from measurement with the tape or trundle wheel they could suggest pacing out the distance.)

  Carry out the measurement in all the ways suggested.

- Have a discussion about the accuracy of measurement, considering these questions:

  Is pacing out the distance close enough?

  When would you need to be very accurate and when is an approximation good enough?

  eg. checking a block of land or the size of a mat for a room are often done by pacing but a builder laying housing foundations needs a good tape.

- Now try to find an object about 20m away, 50m away, 100m away. If students have counted their paces for 10 metres you could try distances which are multiples of 10 metres. eg. if 12 paces is 10 metres then 36 paces is 30 metres.

- Estimating other lengths

  Pick a variety of distances,
  eg.
  - width of the road
  - the dimensions of a house block
  - length of a car

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Ask students to first:

- guess the length by looking
- then refine their estimate using paces
- finally check by measuring with tape and trundle wheel

Extensions

How long does it take to walk 100m?
Measure the actual time taken by students.

How long would it take to walk 1 km?
Use the time measurement for 100m to estimate how long this would take.

Actually walk 1km by pacing out 1 km in 10 lots of 100m, and measure the time taken.

METRIC ACTIVITIES - THE LITRE

Skills Developed
- Estimation
- Understanding relative sizes of measurements in millilitres and fractions of a litre
- Measuring volume

This session consists of two activities designed to increase students' knowledge about measuring in litres and millilitres.

Activity 1 uses common containers of liquids and labels to show alternative ways of naming the same quantity.

Activity 2 is an estimating and measuring activity using paired container and cup or glass.

PREPARATION

Use containers which are familiar eg. milk cartons (3 sizes), beer bottle, soft drink can and bottle, icecream container, juice containers, cordial bottles. Block out the volume label on each. You can have more than one container of the same volume, but preferably a different shape. Compare short fat containers to long thin containers. One way to collect these is to ask your students to bring in empty containers (well in advance). This ensures they are products with which they are familiar.

Make up a card to match each container with the volume written on it, as it was written on the container. You could make up some extra labels (to use later) with the volume written in another way.

eg. 1.25 litres and 1 litre 250ml
500ml and half litre

SESSION OUTLINE

Materials
Activity 1
- A collection of common liquid containers with volume blocked out (see Preparation)
- Small cards
- Measuring jug

Activity 1 Matching volume labels and containers

- As a group ask the students to arrange the containers from smallest to largest . Warn them that some are the same size.
- Give each student one or more label cards and ask them to match them to a container.

Ask students:

What does ml stand for? (Millilitres)
How many ml make 1 litre? (1000)

- Any disputes can be resolved by filling the container with water or dry substances, (rice, lentils) and measuring the volume with a measuring jug or using a smaller container.
- When the card matching is completed ask students to discuss:

  Which containers were easiest to match?
  Which were hardest? Why?

  As this stage you will find many of your students are quite familiar with the capacity of common shopping items, eg. 1 litre of milk, 2 litres of icecream. Use this to point out that they **do** have knowledge of the metric system and can estimate larger volumes by imagining how many of these will fit.

Extensions

1. Use other labels and fractions to match with the containers in Activity 1.
   eg. 250ml or 1/4 litre or 0.25 litre.
2. By visualising a litre or 2 litres guess:

   How big is a bucket?
   How much water fits in the sink?

   Check at home or in class for the actual volume.

Activity 2 Estimating how many glasses from each container

Materials

Activity 2

- Containers and glasses
- Water and a handy sink
- Worksheet 1

Pair a suitable glass with the appropriate bottle. eg. wine bottle and wine glass; beer bottle and beer glass; teapot and mug; soft drink bottle or 1 litre milk carton and tumbler; medicine bottle and medicine glass.

Each student starts by estimating how many glasses can be filled from the appropriate container and writes down their estimate in each case in the estimate column on **Worksheet 1.**

When everyone has written down their guess, working in pairs or as a group fill the containers with water and count the number of glasses which can be poured from each bottle. Fill in the remaining column on **Worksheet 1.**

Extension

- If students understand the concept of division, you can divide to find the volume of each glass.

eg. 1000ml divided between 4 = 250ml
(1 litre milk) (glasses)

ie. 1000 ÷ 4 = 250

How many glasses from a bottle

Bottle or container	Estimate of number of glasses	Measured number of glasses

1991 Strength in Numbers: Goddard, Marr, Martin

METRIC ACTIVITIES - THE KILOGRAM

Skills Developed

- Understanding information on supermarket labels
- Use of weighing scales
- Reading weighing scales
- Calculating price of fractions of 1kg from price per kg.

This session provides discussion and activities to familiarise students with

- the kilogram
- fractions of a kilogram
- connections between grams and kilograms and even larger weights

Activity 1 uses labels from prepackaged food and investigates the information given on the labels.

Activity 2 provides a method for working out the price of a quantity which is a fraction of a kilogram.

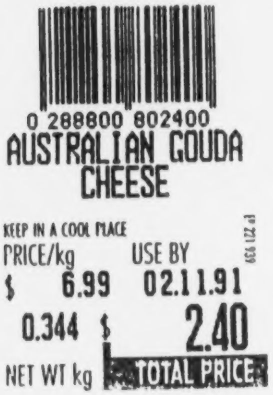
Activity 3 involves weighing newspapers and calculating the weight of newspaper used in a year.

SESSION OUTLINE

Activity 1 Reading Information off Prepackaging Label

Materials
Activity 1

- Labels from prepackaged food items
- Worksheet 1



0 288800 802400
AUSTRALIAN GOUDA CHEESE
KEEP IN A COOL PLACE
PRICE/kg USE BY
$ 6.99 02.11.91
0.344 $ 2.40
NET WT kg TOTAL PRICE

Preparation

Collect a number of labels (ask the students to help) from supermarket packaged foods (meat and delicatessen items). See diagram.

- Pass the labels around the group and students work individually or in pairs to find the information on the label to fill in the table on **Worksheet 1.**

- Ask students to read aloud Net Wt, Price/kg as 'net weight' and 'price per kilogram'. Discuss the meaning of net weight (weight inside the package).

- Also ask students:

  What is another name for a kilogram? (Kilo)
  How many grams make 1 kilogram? (1000)
  What other measurements have 'k' in front?
  (km, kW-kilowatt. k stands for kilo and means 1000)

Some ways of explaining the meaning of 0.430kg.

1. Ask students to think about the decimal way of writing dollars and cents.
   such as \$0.62 means 0 dollars and 62c.
   0.430kg means 0kg and 430g.
2. 0.430is a bit less than 0.500kg (500g) which is half a kilo.

Extension

- This exercise could be followed up by a visit to a supermarket, butcher and delicatessen to compare the price per kg of packaged and non packaged foods. eg. prepackaged mince and butcher's mince.

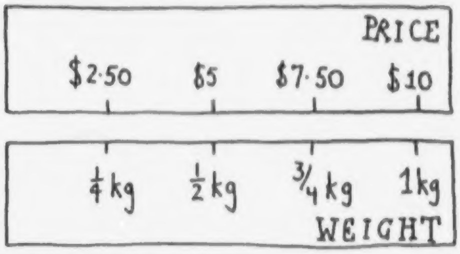
Activity 2 Simulation of electronic scales

Preparation

Make a number of cardboard strips using **Worksheet 2** by pasting on to cardboard and cutting out each strip.

- Ask students how the price of 5 slices of ham is worked out in the supermarket. ie. it is weighed, the sales assistant punches in the price per kg, the electronic scales work out the cost and print a label.

- In this activity the cardboard strips prepared from **Worksheet 2** represent the weight on the scales. The price is filled in on the blank strips from **Worksheet 2.** As an example, fill in the price strips for fish costing \$10 per kg.



- Students work on their own and use the cardboard weight strips matched with a prices strip to find these:
  - the cost of 600g of fish
  - 750g of fish
  - quarter kg of fish
  - the amount of fish which could be bought for \$2,
  - the amount of fish \$5 would buy

Materials

Activity 2

- Cardboard strips marked with weight made from Worksheet 2

- Students then make up other price strips for some other prices per kg. eg. $12, $8 and match up weights with price. You may need to write some weights on the board.

- After two or three examples students could make their own strips, including fractions and decimals which could be used for ready reference.

- It may be useful to have a discussion at the end about how students buy items at the delicatessen or butcher.

  What do you ask for? 0.25kg or 250g.

  What is a reasonable weight to buy if you were buying, eg. coffee, sliced ham, olives?

Materials

Activity 3
- A week's supply of one or two newspapers
- Calculator
- Scales for weighing

Activity 3 The weight of newspaper used in a week

Preparation

Collect or ask the students to collect a week's supply of one, or if possible two or more, daily newspapers, eg. rival morning papers, one morning and one evening.

- Explain that the task is to find the weight of newspaper you would have at the end of a week if you bought a paper each day.

- To make it a weighing exercise weigh each day's paper separately and find the total by adding. Repeat the weighing with another paper if possible and compare the totals.

- Estimate the total weight of paper a person would have as waste by the end of the year. Multiply by 52 using a calculator.

- If you have some recent figures about recycling newspapers you could discuss them. eg. these from 1987-88:

  622,000 tonnes of newsprint is produced each year in Australia.
  200,000 tonnes is recycled into packaging not newsprint. (Cannot take off ink).
  The rest is buried - how many tonnes is this?

- Further discussion points which you could bring up, or students may spontaneously raise:

  How could we reduce our waste from newspapers?

  Do we need to buy a newspaper when we have TV?

  Are there some sections of a newspaper, such as classifieds, which could be organised so there is not such a waste of paper?

- If your group is particularly interested in conservation issues you could develop some activities to be done in class. Many ideas are included in a booklet produced by the Gould League of Victoria:

  Recylcing Extension Activity Book.
  Gould League of Victoria,
  Box 446, Prahran, 3181.

THE KILOGRAM

Worksheet 1

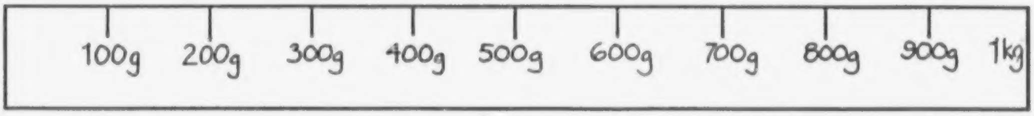
Labels

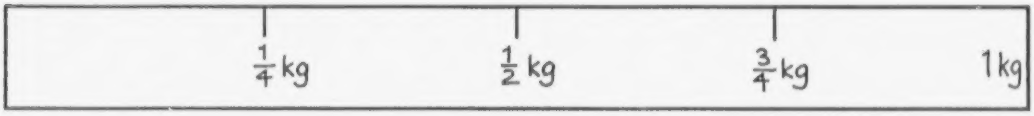
Name of food	Total Price	Use by Date	Net Wt kg	Price/kg

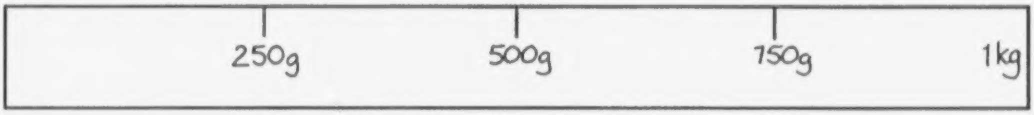
THE KILOGRAM

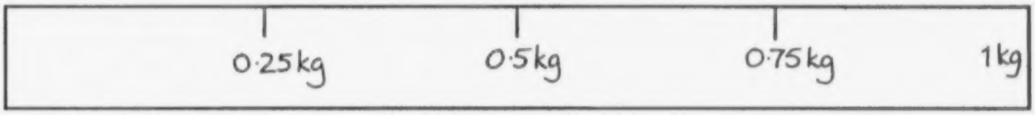
Worksheet 2

Weights - Paste on to cardboard and cut out strips.


100g
200g
300g
400g
500g
600g
700g
800g
900g
1kg


$\frac{1}{4}$ kg
$\frac{1}{2}$ kg
$\frac{3}{4}$ kg
1kg


250g
500g
750g
1kg


0·25kg
0·5kg
0·75kg
1kg

Money - Paste on to cardboard and cut out strips.
Fill in appropriate prices.

METRIC WORKSHEETS

Skills Developed
- Problem solving with metric units

Materials
- Worksheets 1, 2, 3, 4

This session contains some worksheets involving metric units. We have provided some practical examples which could follow or be used in conjunction with *Metric Activities*.

SESSION OUTLINE

As a tutor/teacher you will find that many opportunities arise for making up exercises on everyday measurement. The worksheets included here will provide a starter in this area, and hopefully be a springboard to further ideas.

Outline of Worksheets

- **Worksheet 1 and 2:** calculations using the weight of one cup of sugar and volume of one cup of water.
- **Worksheet 3 and 4:** looking at medicine doses.
- **Worksheet 5:** Sewing - interpreting the information on the back of a pattern. This needs to be done together in class because of the complexity - the information comes from a real pattern.
- **Worksheet 6:** Cooking - measuring ingredients for a recipe which could be made in class (no cooking needed).

These worksheets could be done in class together, or, if the students can cope with them, they could be done at home.

Do not give too many at once; if appropriate, present one question at a time.

Some questions could be answered by doing them practically rather than on paper, eg. **Worksheet 6.**

Further Suggestions

1. Look at mail order catalogues and work out the actual size of some of the goods compared with the impressions given in the pictures.
2. Using a Public Transport map, or other map of Melbourne or your city, make up a paper ruler using the scale given and read off some distances of interest to your group.

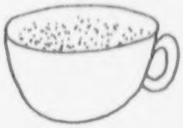
eg: *How far is it to the city?*
How far to the class from everyone's home?

3. Use a sales catalogue from a hardware store and do some calculations for house or garden improvements.

eg. *How many tiles do you need to buy to cover your kitchen floor?*
The length of clothes lines?

or just look for metric measurements.

Further useful exercises are provided in
Maths: A New Beginning Metrics and Measurement section
Ten at a Time, Books 1-5.



1 cup sugar weighs 250g

1. Chutney needs 500g of sugar. How many cups is this?

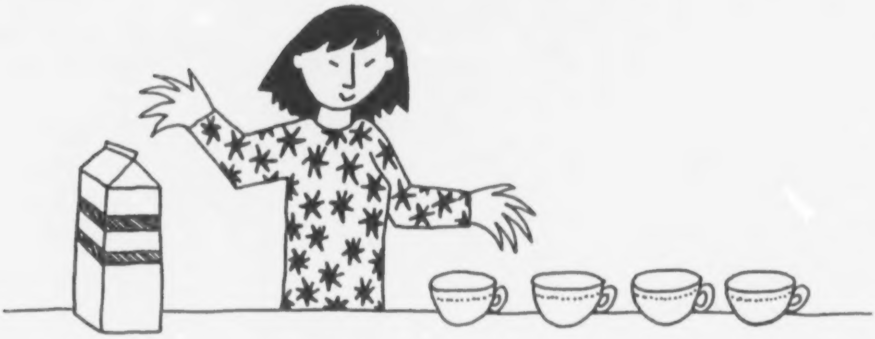
2. What does half a cup of sugar weigh?

3. 1kg of sugar would give how many cups?

4. What does 1 and a half cups of sugar weigh?

5. 750g of sugar is needed for making jam.
   One cup has been put in.
   How many more cups are needed?

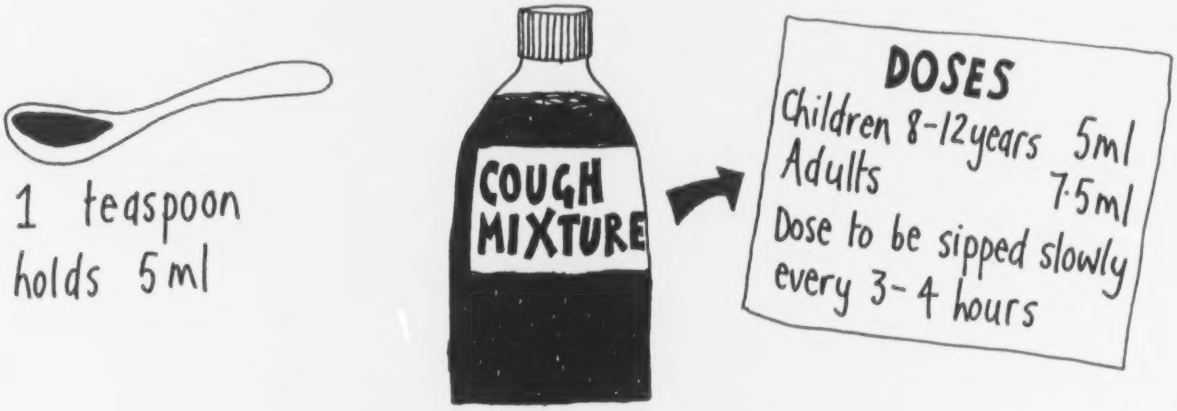
METRIC Worksheet 2



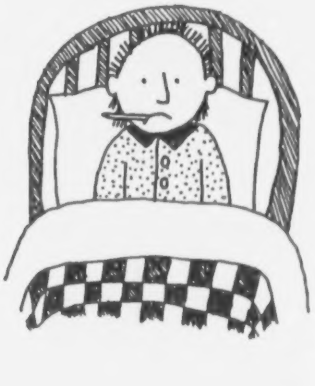
1 litre of milk gives 4 cups

1. 1 litre of milk gives 4 cups. How much in each cup?
2. How many cups in half a litre?
3. How many litres is 6 cups of milk?
4. How would you measure a quarter litre?
5. How many cups would a wine bottle (750ml) fill?

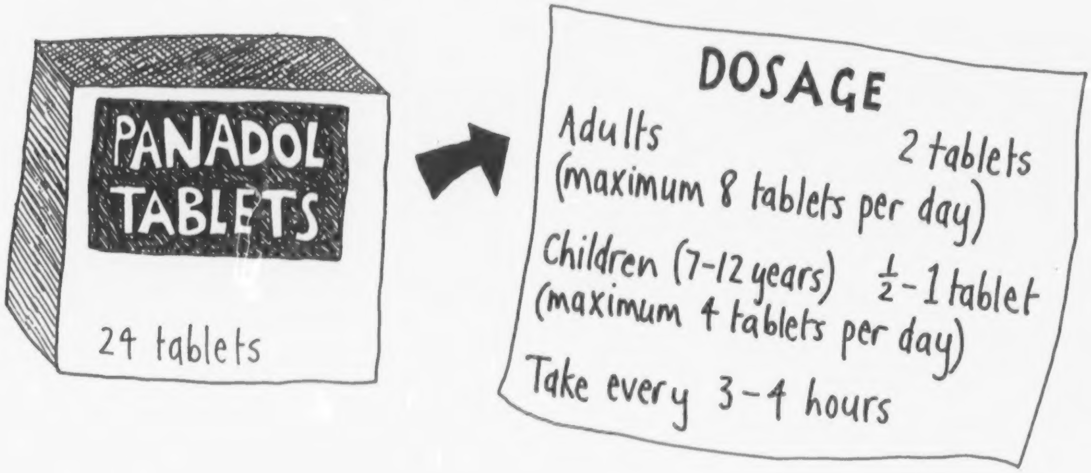
METRIC Worksheet 3


1 teaspoon
holds 5ml
COUGH
MIXTURE
DOSES
Children 8-12years 5ml
Adults 7·5ml
Dose to be sipped slowly
every 3-4 hours

1. How many teaspoons are needed for a 10 year old child?
2. The adult dose is 7.5ml.
   How many teaspoons for an adult?
3. A child has cough mixture before school at 8.30am.
   When should the next two doses be taken?
4. How many teaspoonsful can you get from a full bottle?



METRIC Worksheet 4


PANADOL TABLETS
24 tablets
DOSAGE
Adults 2 tablets
(maximum 8 tablets per day)
Children (7-12 years) ½-1 tablet
(maximum 4 tablets per day)
Take every 3-4 hours

1. Vince has flue.
   He has 2 tablets every 3 hours starting at 7 am.
   When should he stop taking them?

2. If he only took 1 tablet every 3 hours, how many tablets will he take in 24 hours?

3. How many days will the packet last if he takes 8 tablets each day?

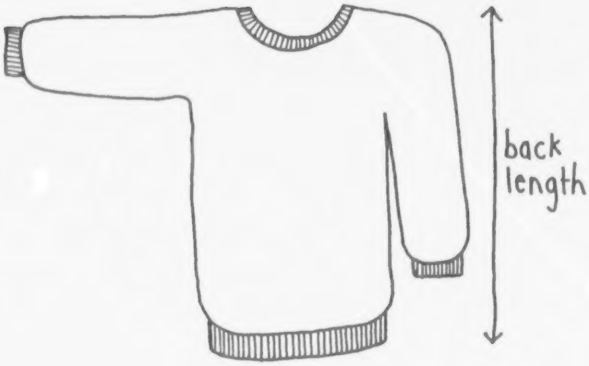
4. Loretta is 8.
   She has flu.
   What tablets should she take?

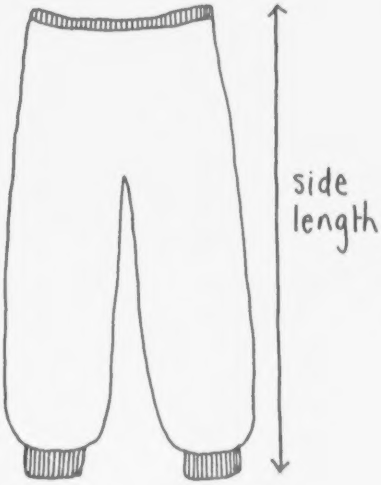
METRIC Worksheet 5

Pattern **Boys tracksuit size 10**

Back length from normal neckline (including bands)			57cm
Side length of pants from waist			82cm
Measurement	at chest		97cm
	at hipline	(top)	95cm
		(pants)	83cm

1. Fill in the lengths given above in the right places on the drawings below.





2. Jimmy's measurements are: chest 71cm
waist 64cm
hip 75cm

How much extra does the pattern allow around hips on tracksuit top?

3. To make 2 pairs of pants for Jimmy how many metres of elastic do you need?

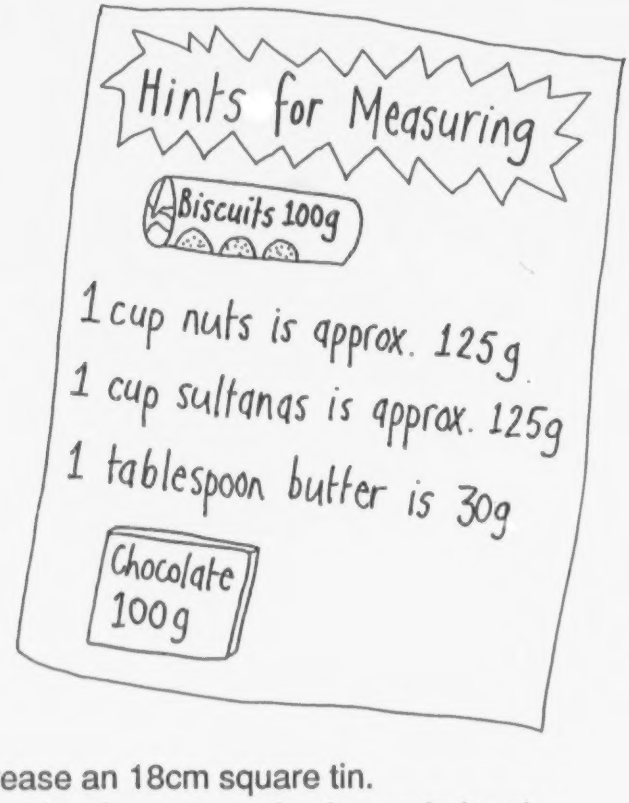
4. To make a tracksuit, you need 2 metres of material.
How much will it cost if material is $11.50 per metre?

CHOCOLATE SLICE

150g crushed biscuits
60g chopped walnuts
60g sultanas
2 tablespoons golden syrup
75g butter
60g dark chocolate

Recipes
CHOC

If you do not have any scales how will you measure each ingredient?



Hints for Measuring

Biscuits 100g

1 cup nuts is approx. 125g
1 cup sultanas is approx. 125g
1 tablespoon butter is 30g

Chocolate 100g

Method
Grease an 18cm square tin.
Mix biscuits, nuts and sultanas in bowl
Heat golden syrup, butter and chocolate in a pan over hot water.
Mix with biscuit mixture
Spoon into prepared tin, press down
Chill until set. Cut into bars

METRICS AND MONEY Answers

SHOPPING WORKSHEET 1

1.	$1.30	6.	10c
2.	$1.05	7.	70c
3.	$1.35	8.	20c
4.	90c	9.	40c
5.	60c	10.	65c

SHOPPING WORKSHEET 2

1.	$1.25	6.	$1.10
2.	$1.30	7.	$1.40
3.	$1.00	8.	$1.60
4.	$1.00	9.	$2.00
5.	70c	10.	$1.20

QUICK QUESTIONS WORKSHEET 1

A.	1.	40c	B.	1.	$2.00	C.	1.	$4.50
	2.	70c		2.	$4.00		2.	$2.95
	3.	50c		3.	$5.00		3.	$5.95
	4.	10c		4.	$3.00		4.	$9.95
	5	60c		5.	$1.00		5.	$5.40
	6.	75c		6.	$7.00		6.	$19.50
	7.	20c		7.	$20.00		7.	$1.75
	8.	70c		8.	$8.00		8.	$7.50
	9.	95c		9.	$40.00		9.	$9.90
	10.	$1.15		10.	$9.00		10.	$8.95

QUICK QUESTIONS WORKSHEET 2

A.	1.	5	B.	1.	$1.20	C.	1.	$8.50
	2.	8		2.	$2.50		2.	$6.50
	3.	4		3.	$20.00		3.	$7.50
	4.	7		4.	$160.00		4.	$3.50
	5.	10		5.	60c		5.	$2.50
	6.	30		6.	20c		6.	$1.40
	7.	60		7.	$18.00		7.	$17.50
	8.	10		8.	$5.00		8.	$9.50
	9.	20		9.	$60.00		9.	$14.50
	10.	15		10.	70c		10.	$8.50

METRICS AND MONEY Answers

QUICK QUESTIONS WORKSHEET 3

A.	1.	5 min	B.	1.	3 months	C.	1.	20 mins
	2.	30 sec		2.	6 hours		2.	50 mins
	3.	15 min		3.	15 min		3.	½ hour
	4.	12 min 30 sec		4.	1½ hours		4.	1 hour
	5	6 hours		5.	15 sec		5.	80 min
	6.	6 months		6.	½ hour		6.	24 hours
	7.	1 week		7.	20 min		7.	2,000 gm
	8.	2½ hours		8.	10 cents		8.	200c
	9.	¾ hour		9.	$5.00		9.	600c
	10.	1 hour 20 min		10.	250 gm		10.	2000 ml

QUICK QUESTIONS WORKSHEET 4

A.	1.	750 g	B.	1.	2 am, 30 min	C.	1.	$3.00
	2.	850 g		2.	3 pm, 45 min		2.	$16.00
	3.	350 g		3.	4 pm, 20 min		3.	$38.00
	4.	650 g		4.	11 am, 35 min		4.	$11.00
	5	875 g		5.	1 am, 5 min		5.	$30.00
	6.	1 L		6.	10 am, 38 min		6.	$75.00
	7.	700 ml		7.	6 am, 14 min		7.	$31.00
	8.	250 ml		8.	8 am, 5 min		8.	$111.00
	9.	500 ml		9.	7 pm, 25 min		9.	$12.00
	10.	300 ml		10.	5 am, 2 min		10.	$52.00

CALCULATOR AND MONEY WORKSHEET 1

TOTAL	$2.85	TOTAL	$22.56
CHANGE	15c	CHANGE	$2.44
TOTAL	$29.60	TOTAL	$12.95
TOTAL	$25.70		

METRICS AND MONEY Answers

CALCULATOR AND MONEY WORKSHEET 2

A.	1.	$20c	B.	1.	$16.67	C.	1.	1.75
	2.	$1.20		2.	$18.75		2.	$2.50
	3.	$6.50		3.	$5.83		3.	8
	4.	$2.05		4.	$34.67		4.	$2.50
	5.	$13.60		5.	$2.40		5.	$166.67
	6.	5c		6.	$5.33			
	7.	60c		7.	$10.96			
	8.	$10.05		8.	$3.33			
	9.	$2.50		9.	$5.08			
	10.	6c		10.	$8.21			

METRIC WORKSHEET 1

1. 2 2. 125g 3. 4 cups 4. 375g 5. 2 cups

METRIC WORKSHEET 2

1. 250ml 2. 2 cups 3. 1.5L 4. 1 cup 5. 3 cups

METRIC WORKSHEET 3

1. 1 tspn 2. $1\frac{1}{2}$ tspn 3. 12.30 pm; 4.30 pm

METRIC WORKSHEET 4

1. 7 pm 2. 8 tablets 3. 3 days 4. $\frac{1}{2}$ - 1 tablet every 3-4 hours

METRIC WORKSHEET 5

2. 20cm 3. 1m 28cm 4. $23.00

METRIC WORKSHEET 6

crushed biscuits	$1\frac{1}{2}$ packets
chopped walnuts	Approx. 2 cups
sultanas	Approx. $\frac{1}{2}$ cups
butter	$2\frac{1}{2}$ tablespoons
dark chocolate	Approx. $\frac{1}{2}$ packet

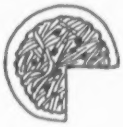
▸ FRACTIONS AND PERCENTAGES ◂

FRACTIONS
Introductory Notes

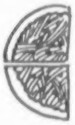
Fractions are often a trouble spot. And yet the concept of a fraction is a practical, everyday idea that people are familiar with eg. cutting a pizza into quarters to share among 4 people. The difficulty arises when **formal** operations on fractions are introduced. The operations of **+**, -, **X** and ÷ on fractions, when developed formally, are sophisticated concepts. They are included in the school mathematics curriculum to help develop a deeper understanding of decimal numbers, and as a prerequisite for studying algebra. As such, they have no place here. Rather, the emphasis in this section is on understanding the concept of a fraction, and on handling simple fraction situations that arise in everyday life.

There are three sessions:

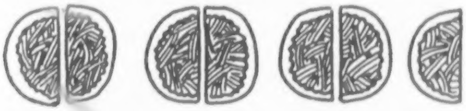
1. **Fraction of a Whole**

   example:  3/4 of a pizza

2. **Equivalent Fractions, Improper Fractions and Mixed Numbers**

   example: 

   Eating 2/4 of a pizza is the same as eating 1/2

   3 1/2 pizzas can be cut into 7 half pizzas.

3. **Doing Things With Fractions**

   This session presents some simple fraction operations in the context of real-life activities. The approach is informal, and not based on developing rules.

FRACTION OF A WHOLE

Skills developed:
- Understanding the concept of fraction
- Understanding fraction notation

Materials:
- Worksheet 1, 2, 3
- Scissors
- Heavy coloured paper (available at most stationers and newsagents)
- Cardboard

In this session we look at the concept of a fraction as *part of a whole*. To do this, we use the idea of sharing out a pizza. A circle is a good shape for cutting into parts and it can easily be seen when you have a whole. Also the idea of sharing out food comes pretty naturally to most people.

Paper circles provide the model for a pizza, and in the activities that follow students cut up paper circles and name the resulting fractions.

PREPARATION:

1. Using the circle on Worksheet 1 as a guide, cut out circles in heavy paper in the colours:
   - red
   - pale green
   - dark green
   - brown

2. Using the one third circle on Worksheet 1 as a guide, cut several cardboard templates for student use in Activity 3.

   Note: The number of circles required will depend on the number of students in your group.

SESSION OUTLINE

The activities below involve the students in cutting up circles to make models of 1/2's, 1/3's, 1/4's, 1/6's and 1/8's. The activities are designed for group work.

In each of the 5 activities, a different coloured paper is recommended for the circles. This makes the fractions easier to identify when they are used again in later sessions.

Use all or any of the 5 activities below, and extend the idea further if you want to look at fractions other than 1/2, 1/3, 1/4, 1/6, 1/8.

(**Note**: *"Maths: A New Beginning"* has further work on fractions).

1. **What is a 1/2?**

A red "pizza", and a pair of scissors.

Ask students to share it **equally** between two - both students are hungry and want their equal share.
Suggest folding, before cutting, to make sure the division is equal.

Ask *How much does each student get?*
A verbal answer of "one half" will be given.

Write this on the board as 1/2.

Ask students to write it on their piece of "pizza".

Talk about the meaning of the "2" and the "1" in this fraction notation:

ie.
- the "2" on the bottom line (the **denominator**) tells you how many pieces the whole has been chopped into;
- the "1" on the top line (the **numerator**) tells you how many of those pieces you have.

Note: the use of the words "denominator" and "numerator" are not necessary. They are included here in case your students recall these terms from school and wish to discuss them.

2. **What is 1/4?**

A pink "pizza" and a pair of scissors.

Ask Student to share it equally between 4.
Suggest folding before cutting, to help make the division equal.

Ask *How much does each student get?*
Most probably a verbal answer of "one quarter" will be given.

Write this on the board as 1/4.

Ask students to write it on each of the four pink pieces of "pizza".

Talk about the meaning of the "4" and the "1" in 1/4.

What is 3/4?

Ask Students to put 3 pink pieces of "pizza" together. How much of a "pizza" do they have altogether?
The verbal answer of "three-quarters" may be given. If not, discuss that you have 3 of the pieces called "quarters", which means that you have "3 quarters" altogether.

Write this on the board as 3/4.

Talk about the meaning of the "4" and "3" ie. the 4 on the bottom line tells you that the whole has been chopped into 4 pieces, and the 3 on the top line tells you that you have 3 of these 4 pieces.

Note: at this stage avoid asking students to put 2 quarters together. These will most probably be seen as 1/2, rather than 2 quarters, which, although of course correct, detracts from the focus of this session. This concept of equivalent fractions is tackled in the next session.

3. **What is 1/3?**

One pale green "pizza".

Ask students to share it equally between 3.

Note: Obviously to divide a circle into 3 equal parts cannot be done by folding. So here it will be necessary to provide students with the cardboard template of 1/3 of a circle which they can trace around.

Ask *how much does each student get.*

Write "1/3" on the board and discuss the meaning of the "3" and the "1".

Ask students to write "1/3" on each of the three green pieces of pizza.

Ask students to put 2 green pieces of "pizza" together.

Ask how much of a whole "pizza" is that altogether?

Write the answer of "2/3" on the board and discuss the meaning of the "3" and the "2".

4. **What is 1/8?**

One brown "pizza".

Ask students to cut it into quarters.

Now suggest that they are not so hungry and will each cut their quarter "pizza" into half again (by folding), so that they can eat one piece now and save the other piece for later.

After these cuts have been made, ask the students to put all the pieces together, and count the total number. Ask them to check that they are the same size (roughly!) as each other.

Ask *what fraction is one of these 8 pieces of the whole "pizza".*

Write "1/8" on the board and discuss the meaning of the "8" and the "1".

Ask students to write "1/8" on each of the eight brown pieces of "pizza".

Put some of the eighths together to give fractions like 3/8, 5/8, 6/8, 7/8. Write these on the board and once again discuss the meaning of the bottom and top numbers.

Note: once again, avoid obvious equivalent fractions like 2/8 = 1/4 and 4/8 = 1/2 at this stage.

5. What is 1/6?

In the same way as 4. above, students can fold and cut dark green "pizzas" to make sixths.

Note: keep these fraction circles that the students have made, for later sessions. Keeping different fraction families in different envelopes is a good idea.

Other ideas for introducing the concept of a fraction as part of a whole:

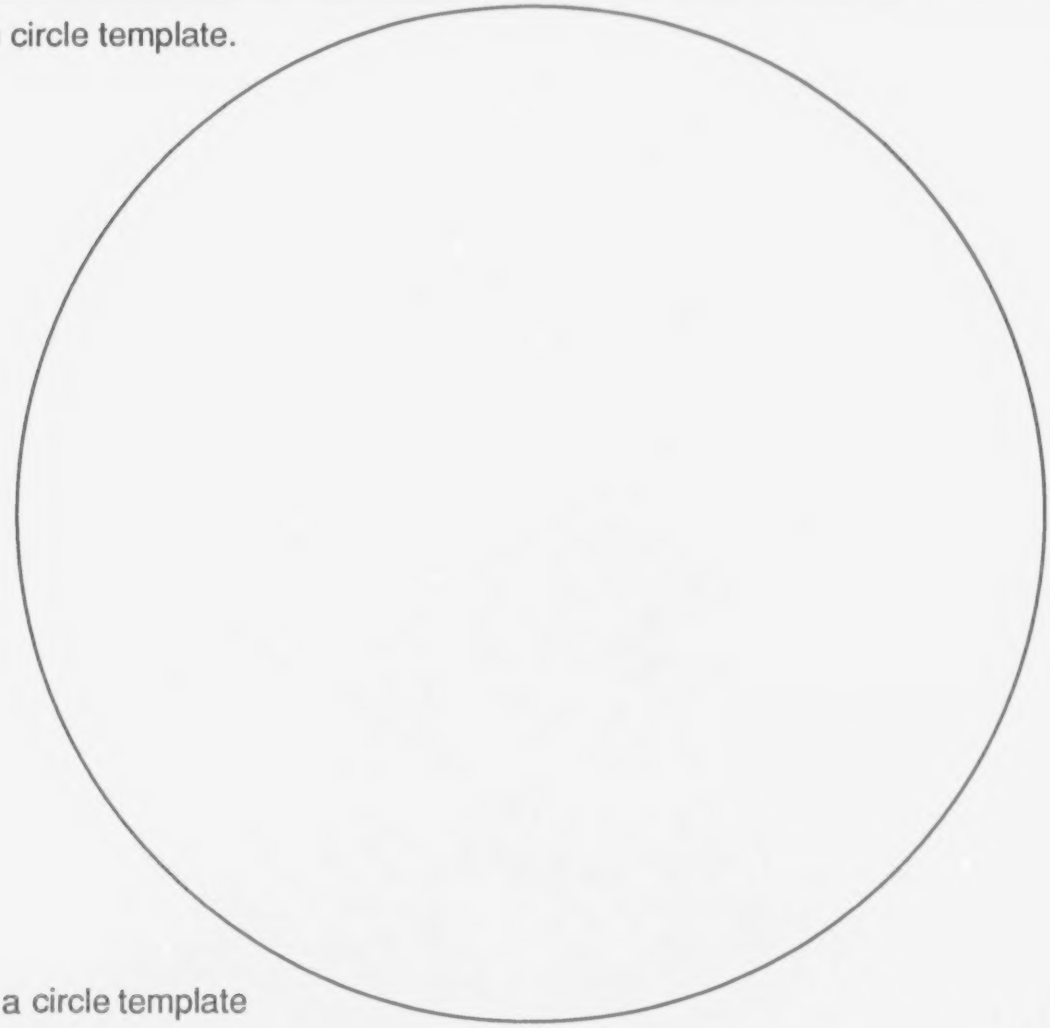
- Use long strips of paper instead of circles. The cutting of these is probably easier than circles, but they are not so readily likened to a familiar food. You could call them chocolate bars. Alternatively, to spark a little more concentrated interest, bring in some **real** chocolate bars!
- If you have the facilities, use a straight sided measuring jug which students can fill with water to levels of 1/2, 1/3, 3/4, etc.
- Cut oranges, apples, a cake.

Use any, or all, of these ideas.

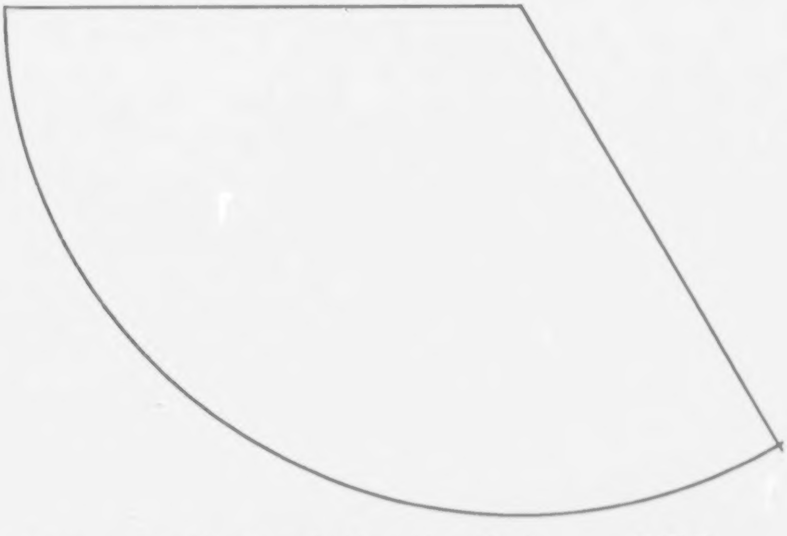
When students can name fractions verbally, and use the written symbol, they are ready to do the Worksheets. We suggest **Worksheet 2** is done in the class time, with the tutor present. Where possible have actual jugs, cup etc. available. **Worksheet 3** could be done for homework.

FRACTIONS OF A WHOLE **Worksheet 1**

Whole circle template.



1/3 of a circle template

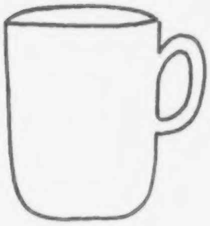


FRACTIONS OF A WHOLE

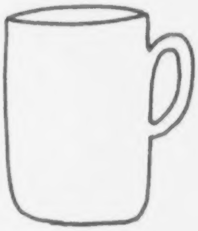
Worksheet 2

1. Cup measures

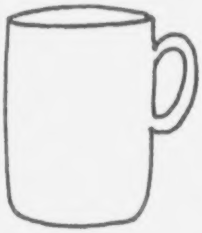
Draw on these:



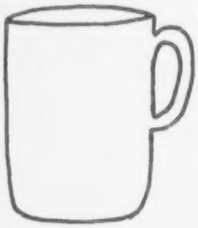
$\frac{1}{2}$ cup



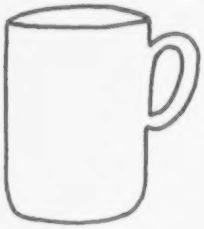
$\frac{1}{4}$ cup



$\frac{3}{4}$ cup

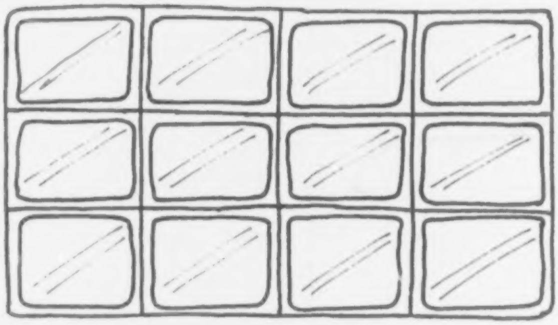


$\frac{1}{3}$ cup



$\frac{2}{3}$ cup

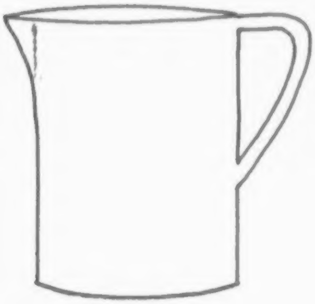
2. Here is a chocolate bar. Share it equally amongst 6 people



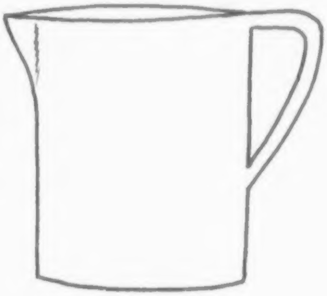
- what fraction of the chocolate bar does each person get?
- how many pieces of chocolate does each person get?

FRACTIONS OF A WHOLE Worksheet 2

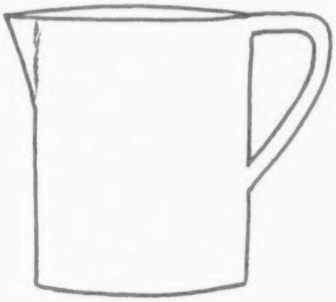
3. A 1 litre jug holds 4 cups.
Mark the level when it is filled with:



1 cup



2 cups



3 cups

What fraction of the jug is filled in each of these?

4. Take a piece of A4 paper.

Fold it in half.

Fold it in half again.

Fold it in half again.

Open it out and cut along the fold lines.

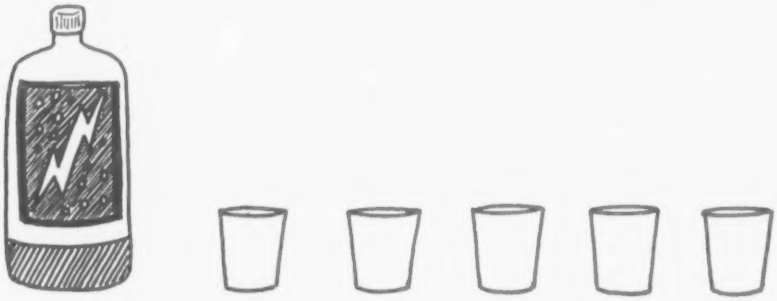
How many pieces do you have?

What fraction of the whole sheet is one of these pieces?

What fraction is 5 of these pieces?

FRACTIONS OF A WHOLE Worksheet 2

5. This bottle of soft drink is poured out equally for 5 children.



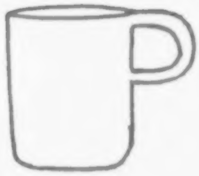
What fraction does each child get?

Jack doesn't want his, so Jill drinks it. What fraction does Jill drink altogether?

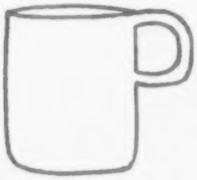
6. Here is a cake recipe:

$\frac{1}{2}$ cup butter
$\frac{2}{3}$ cup sugar
$1\frac{1}{2}$ cups of flour
2 eggs
spices

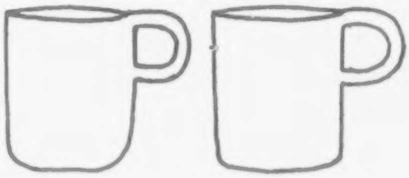
Mark the levels on the cups:



Butter



Sugar



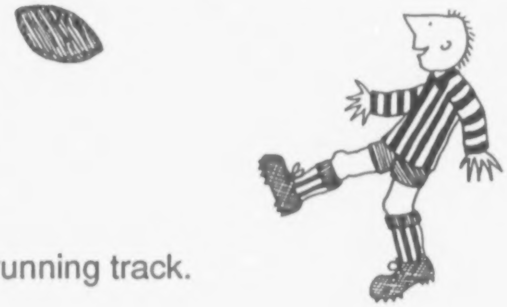
Flour

FRACTIONS OF A WHOLE

Worksheet 3

1. 4 children share an apple. How much apple does each get?

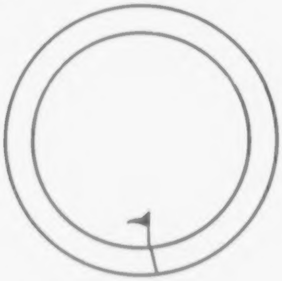
2. When the siren goes for the first break in an AFL match, how much of the game has been played?



After the second siren?

After the third siren?

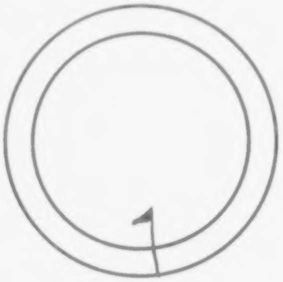
3. A sprint race covers $\frac{1}{4}$ of a circular running track.



starting point

Mark the finishing point.

4. A longer race covers $\frac{2}{3}$ of the track.



starting point

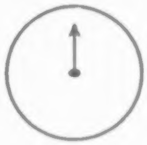
Mark the finishing point.

FRACTIONS OF A WHOLE

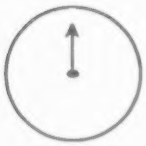
Worksheet 4

Mark the position of the minute hand after it has moved through

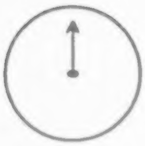
1. Half an hour



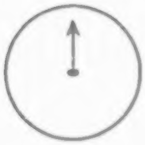
2. $\frac{1}{4}$ of an hour



3. $\frac{3}{4}$ of an hour

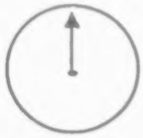


4. 20 minutes



What fraction of an hour is this?

5. 40 minutes



What fraction of an hour is this?

1991 Strength in Numbers: Goddard, Marr, Martin

EQUIVALENT FRACTIONS, IMPROPER FRACTIONS AND MIXED NUMBERS

Pre-skills:

- Session 1 on Fractions

Skills developed:

- Understanding the concept of equivalent fractions, improper fractions and mixed numbers

Materials:

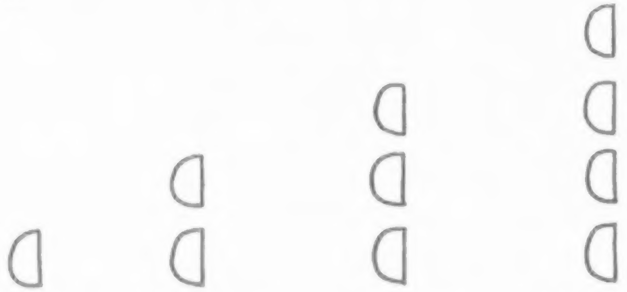
- Fraction circle pieces from Session 1

In this session we use the fraction "pizza" pieces made in Session 1.

Note: You may need to cut extra circles to have sufficient pieces for the following activities.

SESSION OUTLINE

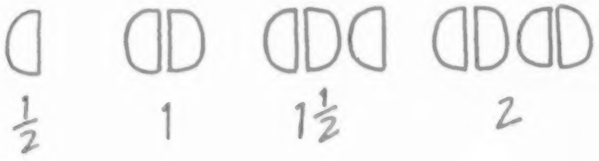
1. Using **all** the half pieces made, ask students to lay them out on the table, one by one, counting by halves as they go:



As they count, you record the fractions on the board:
ie. $\frac{1}{2}$ $\frac{2}{2}$ $\frac{3}{2}$ $\frac{4}{2}$ etc.

Now, by rearranging the "pizza" pieces, they can be counted in a different way:

ie. "a half", "one whole", "one and a half", "two wholes"



and record this on the board as they count.

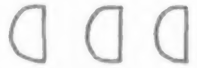
In discussion, compare: 1 and $\frac{2}{2}$
$1\frac{1}{2}$ and $\frac{3}{2}$
2 and $\frac{4}{2}$

Draw student's attention to:

- the meaning of a fraction like $\frac{2}{2}$, where the numerator and denominator are the same;
- the fact that fractions greater than one *do* exist;
- the fact that these fractions can be written as **improper fractions** (eg. $\frac{3}{2}$) or as **mixed numbers** (eg. $1\frac{1}{2}$)

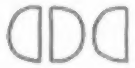
Note: this can just be emphasised **visually** by laying the circle halves out

as



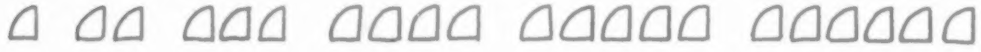
$\frac{3}{2}$

or



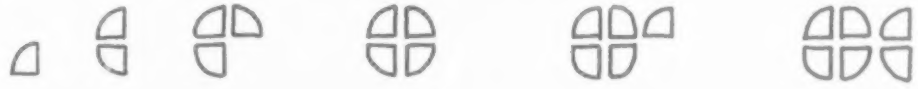
$1\frac{1}{2}$

2. Repeat this using only the quarter pieces. ie. counting by quarters



$\frac{1}{4}$ $\frac{2}{4}$ $\frac{3}{4}$ $\frac{4}{4}$ $\frac{5}{4}$ $\frac{6}{4}$ $\frac{7}{4}$, $\frac{8}{4}$ etc

and then by rearranging the pieces, count as:



$\frac{1}{4}$ $\frac{1}{2}$ $\frac{3}{4}$ 1 $1\frac{1}{4}$ $1\frac{1}{2}$ $1\frac{3}{4}$, 2 etc

In discussion, compare: $\frac{2}{4}$ and $\frac{1}{2}$
$\frac{4}{4}$ and 1
$\frac{5}{4}$ and $1\frac{1}{4}$ etc.

Draw students attention to:

- equivalent fractions eg. $\frac{2}{4}$ and $\frac{1}{2}$
- the meaning of fractions like $\frac{4}{4}$ and $\frac{8}{8}$
- mixed number notation and improper fraction notation eg. $1\frac{1}{4}$ or $\frac{5}{4}$

Once again, these concepts can be emphasised visually by the layout of the circle pieces.At this stage there is no need to look for the formal rules governing these relationships unless some of the students spot them for themselves and are easily able to use them.

3. Repeat for as many other of the fraction families as you wish ie. thirds, sixths, eighths.

DOING THINGS WITH FRACTIONS

Pre-skills:
- Session 1 and 2 on Fractions

Skills developed:
- Ability to find "ad hoc" solutions to fraction operations occurring in everyday life.

Materials:
- Fraction circles cut in Session 1
- Optional "hands on" material for individual activities (see actual details of the session for these)

In this session we look at some operations on fractions. The approach is informal and rather than developing rules, a number of activities are presented, mostly involving "real-life" situations. The emphasis in these activities should be on getting the answer through whatever means the students choose to use, and not on formal rules. The aim is to equip students to handle simple fraction situations that may arise in their everyday life.

If you wish to go further with operations on fractions and introduce the more formal methods to your students, we refer you to: *Maths: A New Beginning* in which fractions are covered in some detail.

Below is a table summarising the actual fraction operations involved in each of the 11 worksheets. These are included here for your reference as the tutor, and need (should) not be spelt out to the students.

OPERATION	ACTIVITY										
	1	2	3	4	5	6	7	8	9	10	11
1. fraction of a whole number	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
2. fraction of a fraction			✓		✓						
3. addition with fractions				✓				✓	✓		
4. whole number X a fraction					✓	✓					✓
5. fraction divided by whole number					✓						
6. whole number divided by fraction					✓						
7. expressing one number as a fraction of another			✓	✓	✓	✓		✓			

SESSION OUTLINE

Here are 11 fraction activities. We suggest these are worked on in a class situation, either individually or in groups, and wherever possible hands-on material is available to help in the solutions.

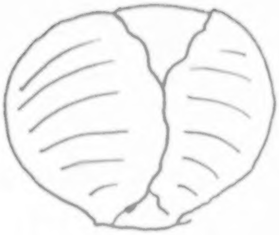
eg. in Worksheet 6 where a dozen eggs are involved, actually have a dozen eggs there.

Each activity is presented in the form of a worksheet so that each student can have their own copy.

Use any or all of these activities in whichever order you like.

DOING THINGS WITH FRACTIONS - VEGETABLES

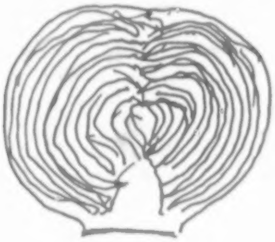
Worksheet 1



Cabbage

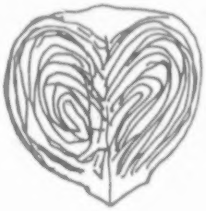
$2.20

Price



Half a cabbage

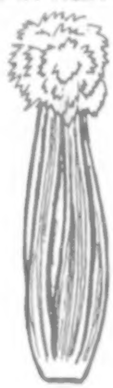
Price



Quarter of a cabbage

Price

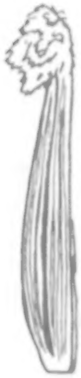
Celery is also sold in halves.



Celery

$1.80

Price



Half Celery

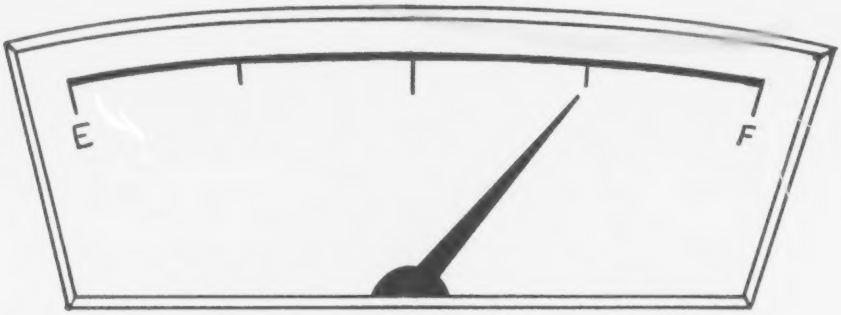
Price

1991 Strength in Numbers: Goddard, Marr, Martin

DOING THINGS WITH FRACTIONS - PETROL GAUGE

Worksheet 2

The petrol tank on Mario's car holds 40 litres.



1. What fraction of the tank is full?

2. How much petrol is this?

3. How many more litres will it take to fill it?

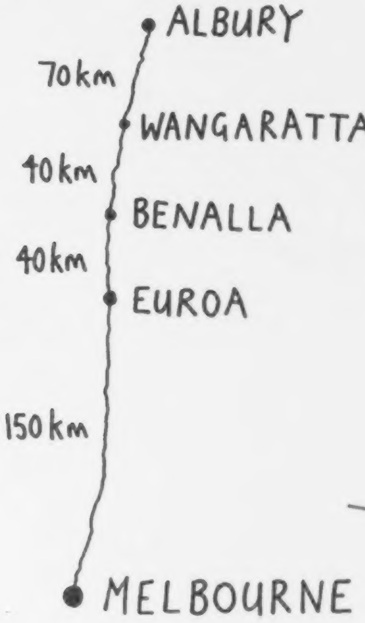
4. Mario fills the car with petrol and goes on a trip. He uses half the tank.
   How much petrol is left?

5. He goes out again and uses another 10 litres.
   How much petrol is left now?

6. What fraction of the tank is this?

DOING THINGS WITH FRACTIONS - TRAVELLING

Worksheet 3


ALBURY
70km
WANGARATTA
40km
BENALLA
40km
EUROA
150km
MELBOURNE

The Lim family are driving from Melbourne to Albury.

1. The trip is .... kilometres long.

2. They want to stop half way for coffee.
   Where will they stop?

3. They think the driving for the whole trip will take $3\frac{1}{2}$ hours.
   How long before they stop for coffee?

4. They arrive at Benalla.
   Roughly what fraction of the trip have they done?

DOING THINGS WITH FRACTIONS - WORKING

Worksheet 4

1. Imelda works half-time. The full-time salary is $350 a week.
   How much does she earn a week?

2. On Saturdays, Liam gets paid time and a half.
   The normal daily pay is $90.
   How much does he get on Saturday?

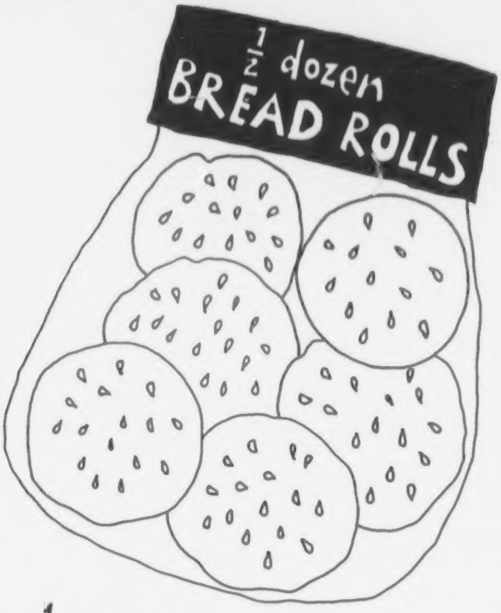
3. Anne has 4 weeks annual holidays. She takes one week in winter, and 3 weeks in summer.
   What fraction of her holiday is spent in winter?

4. Melissa earns $27,000 a year, and pays 1/3 in tax.
   How much tax is this?

DOING THINGS WITH FRACTIONS - BREAD ROLLS

Worksheet 5

These bread rolls are sold in half dozen bags.



1. Children like to eat $\frac{1}{2}$ a roll.
   How many children will one bag feed?

2. Enzo shares his half roll with Ian.
   How much roll does Enzo have?

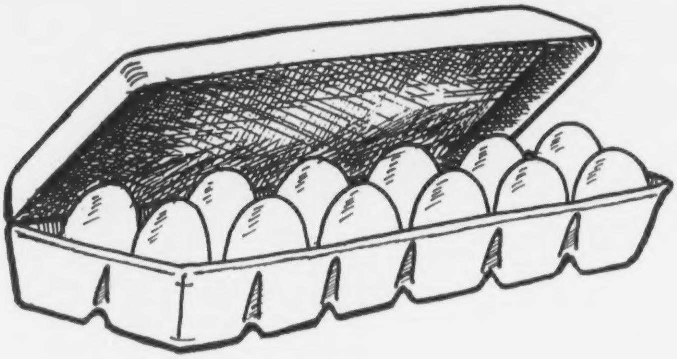
3. Mimi puts $\frac{1}{2}$ the bag in the freezer.
   How many rolls is this?

4. 6 half rolls are used for lunch.
   How many rolls is this?

5. 2 rolls are wasted.
   What fraction of the bag is this?

DOING THINGS WITH FRACTIONS - EGGS

Worksheet 6



1. How many eggs in $\frac{1}{2}$ a dozen?

2. How many eggs in $\frac{1}{4}$ of a dozen?

3. Jim made an omelette using 4 eggs.
   What fraction of the box is that?

4. Josie made a rich fruit cake. She used $\frac{3}{4}$ of a dozen eggs.
   How many is that?

5. How many eggs in $1\frac{1}{2}$ dozen?

DOING THINGS WITH FRACTIONS - PUBLIC TRANSPORT

Worksheet 7

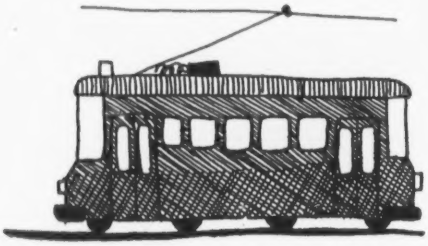
Public Transport Fare Zones & Tickets

3 Hour Tickets

(Prices as at September 1991)

Zone	ADULT	½ ADULT FARE	CONCESSION
Zone 1	$1.80		$0.90
Zones 1 & 2	$3.00		$1.40
Zone 2	$1.25		$0.60
Zones 2 & 3	$2.50		$1.20
Zone 3	$1.25		$0.60
Zones 1, 2, 3	$4.20		$2.10

- What is half the adult fare for each of the tickets?



- Is the cost of a concession ticket always half the adult fare?

- What is the cost of 1 adult and 2 children in Zone 1?

Note: *A **concession** ticket is for children under 15 years and for approved concession card holders such as pensioners, health card holders, or registered unemployed people.*

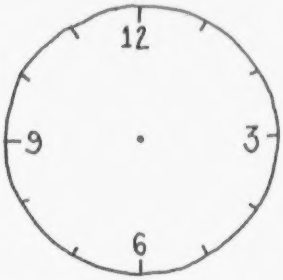
DOING THINGS WITH FRACTIONS - TIME

Worksheet 8

1. It is 10 am. Cyril arranges to meet his friend in $\frac{3}{4}$ hour.
   What time will that be?

2. After they meet they walk to a cafe.
   The walk takes $\frac{1}{4}$ hour and they spend $\frac{1}{2}$ hour in the cafe.
   How much time do they spend together?

3. How many minutes in 1/4 hour?

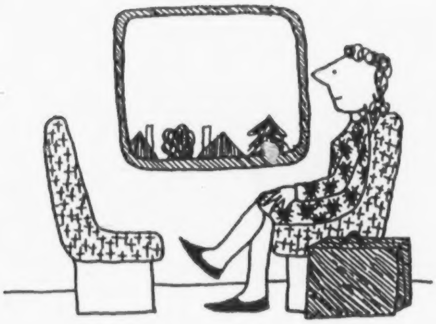


$\frac{1}{2}$ hour?

$\frac{3}{4}$ hour?

4. What fraction of an hour is 20 mins?
   40 mins?

5. How many months in $\frac{1}{2}$ a year?



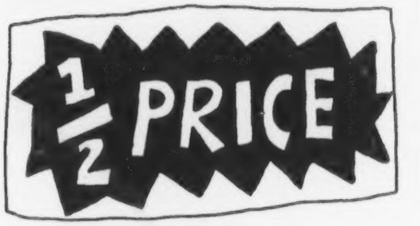
6. Kate catches a train at 11.15 am. The trip takes $2\frac{1}{2}$ hours.
   What time does she arrive?

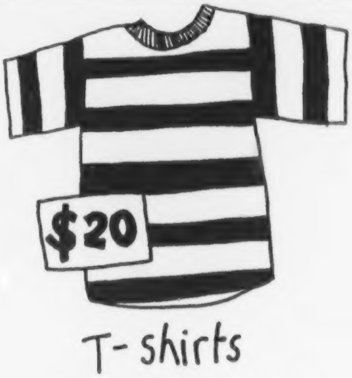
7. Grant leaves for work at 8.00 a.m. It takes him $1\frac{1}{4}$ hours to get ready?
   What time should he get up?

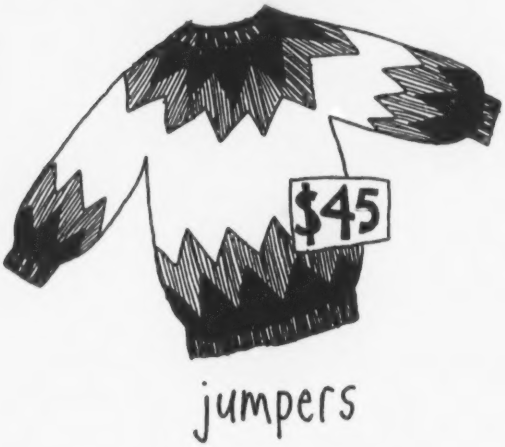
DOING THINGS WITH FRACTIONS - SALES

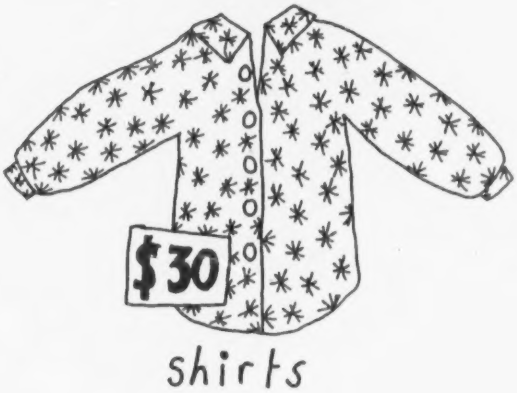
Worksheet 9

How much will these clothes be?

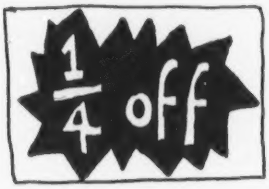


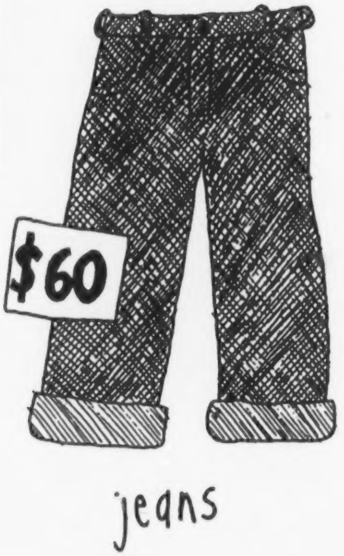


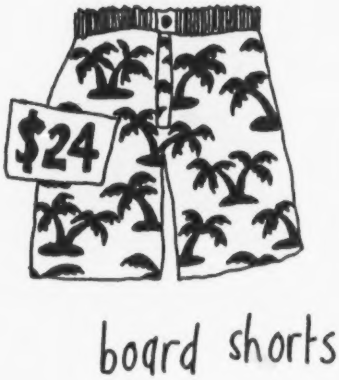




How much will these cost?






$24
board shorts

1991 Strength in Numbers: Goddard, Marr, Martin

DOING THINGS WITH FRACTIONS - COOKING

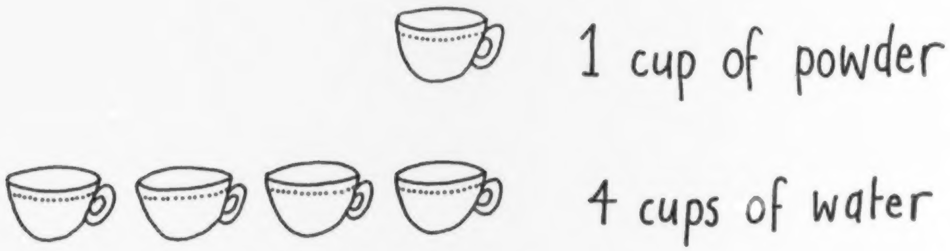
Worksheet 10

1. Here are the ingredients for a nut loaf:

1 ½ cups flour
pinch salt
1 teaspoon mixed spice
¾ cup butter
¼ cup sugar
½ cup chopped walnuts
⅓ cup raisins or sultanas
1 beaten egg
½ cup milk

Freda wants to make a double loaf. What will her ingredients be?

2. The instructions on a powdered milk packet are:



1 cup of powder

4 cups of water

This makes 1 litre of milk.

How much milk powder would you use to make:

- 2 litres of milk
- ½ litre of milk
- 4 litres of milk?

How much milk powder would you add to 1 cup of water?

3. The instructions on a bottle of White King bleach for removing stains are:

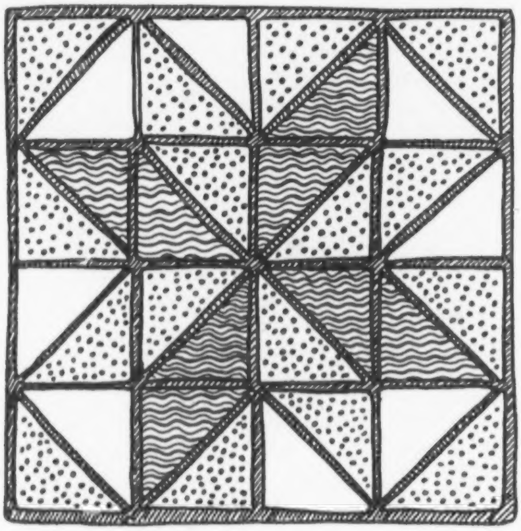
Mix $\frac{1}{2}$ cup of bleach with $2\frac{1}{2}$ litres of cold water and soak.

How much bleach would you use with:

- 5 litres of water
- a bucket of water (a bucket holds 10 litres)
- half a laundry trough of water
  (a laundry trough holds 60 litres)

DOING THINGS WITH FRACTIONS - PATCHWORK

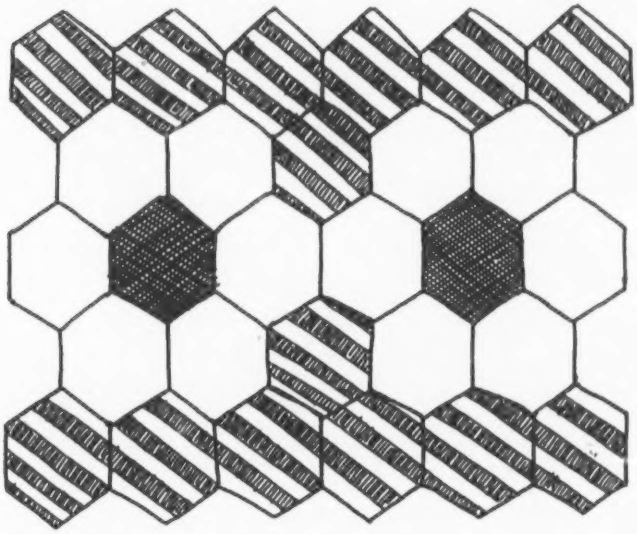
Worksheet 11



How many triangle patches are used in this quilt?

How many of the triangles are spotty?

What fraction of the patchwork quilt is spotty?



What fraction of this patchwork quilt is striped?

INTRODUCTION TO PERCENTAGES

The percentage section is an extension of the fractions sessions. It concentrates on simple percentages such as 100%, 0%, 50%, 25%, 75% and 10% which can be directly related to common fractions. The calculations are not difficult; the emphasis is on understanding of the meaning of percentage.

There are three sessions:

1. **The Meaning of Percent**
   A survey result is used to introduce the concept of percentage.
   Labels on clothing and food, and the newspaper, provide examples of the use of percentage in our daily lives.

2. **Percentage Bars**
   This is an exercise which gives a visual illustration of percentages.

3. **Exercises with Percentages**
   Here are Worksheets which give practice on simple calculations with percentages.

THE MEANING OF PERCENT

Pre-Skills
- Section on Fractions

Skills developed
- An informal understanding of the meaning of percentage

Materials
- Labels from food packaging
- Bank pamphlets
- Examples of percentages from the newspaper
- Worksheet 1

PREPARATION

Bring to the class a collection of examples from the newspaper, enough for one between 2 students. Also bring a collection of food packets or labels which have percentage on them, and bank pamphlets showing interest rates.

SESSION OUTLINE

- Ask the students to name places where they see percentages eg. interest rates, football scores, surveys.
- Write this statement on the board:
  In a survey it was found that 38% of the people could not work out change from a lunch order.

The students may ask questions about this, otherwise direct the discussion with questions like:

What does 38% mean?
More or less than half the people?
What is 'half' in percentage?

If the survey asked 100 people, how many couldn't work out the change and how many could?

- Ask them if they could draw a picture of 38%. To do this, draw a circle on the board, explaining that it stands for all the people or 100%. 50% would be half the circle. Make a guess at where 38% would be.

- Draw on the board circles shaded to show 100%, 50%, 25%, 10%, 0%, and leave them there for reference while looking through everyday examples.

- With the students working in pairs give out the labels, newspaper cuttings and bank information you have brought. Give them some time to discuss the material and then share the information amongst the whole group.

  Ask students to try and explain what the percentage figure means, eg. 40% of the people in a survey did not agree with the prime minister.

Questions you could ask:

> *Do most people agree with him?*
> *Do more than half the people agree with him?*

For money calculations, the percentage is the same as the cents out of $1.

eg. There has been a 6% rise in the cost of living.
What does this mean?
Prices have gone up, and anything costing $1 before, now costs 6c more.

6% means 6 out 100, or 6c out of 100c, or 6c out of $1.

For something costing $5, 6% rise in price means 6c out of every $1. There are $5, 5 x 6 = 30c

New price is $5.30.

Note: Some figures will be difficult to explain; the aim of this exercise is a general awareness of percentage and a *rough understanding* of what it means.

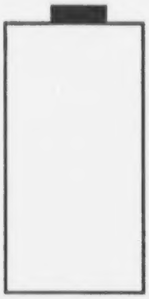
eg. 100% wool on a clothing label means *all* wool.
60% wool means a bit more than half the garment is made of wool.

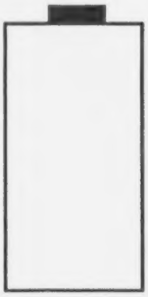
THE MEANING OF PERCENTAGES **Worksheet 1**

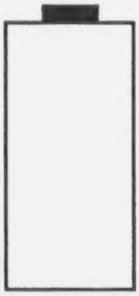
FRUIT DRINKS

Shade the percentage given:

100% fruit juice

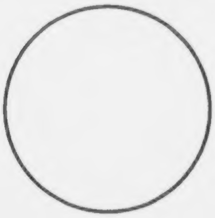

50% fruit juice

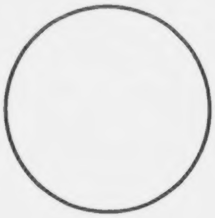

25% fruit juice

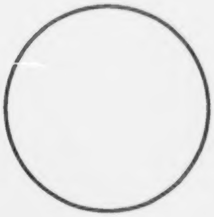

75% fruit juice

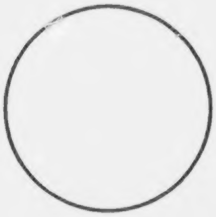
ONE DOLLAR — $1

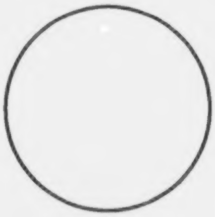
Shade the percentage given and fill in how many cents:

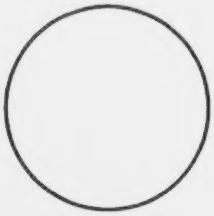

50% = cents


100% = cents


25% = cents


10% = cents


75% = cents


0% = cents

PERCENTAGE BARS

Skills Developed

- Picturing percentages
- Measuring in millimetres with a ruler

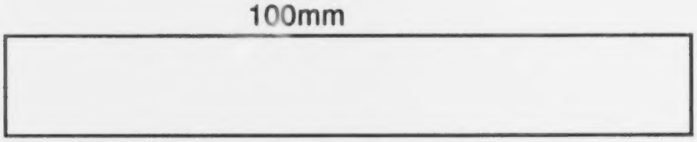
Materials

- One ruler with millimetre divisions for each student
- Worksheet 1

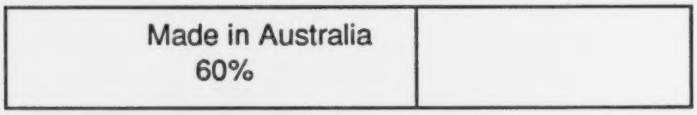
A 100mm bar is a convenient way to show percentages - the whole bar will be 100% and any smaller percentage can be measured off. Demonstrate this to the students with an example:

60% of the goods in a store are made in Australia.

- Draw a 100mm bar to represent all the goods in the store.



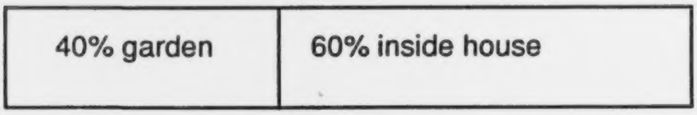
- Mark off 60mm to represent 60% of the goods and label it:



- Ask students what the unlabelled section represents ie. 40% goods made overseas. Label it.

- Now give the students **Worksheet 2.** Using rulers they should divide up the bar to show the percentage given, and then label each section. You may need to discuss together the second label.

eg. 40% of household water is used in the garden.



Calculate the second percentage by subtracting 40% from 100%.

PERCENTAGE BARS Worksheet 1

Measure out the percentage on each bar.

40% of household water is used in the garden

Victoria used to be 90% covered in forest

Victoria is now 35% covered with forest

Chocolate is 57% sugar

64% of men drink alcohol at least once a week

42% of women drink alcohol at least once a week

80% of Aborigines were killed in the 150 years after whites came to Australia

1991 Strength in Numbers: Goddard, Marr, Martin

USING PERCENTAGES

Skills developed

- Calculating with percentages

Materials

- Worksheets 1,2,3,4.

This is a collection of worksheets which provide some straightforward examples using percentages:

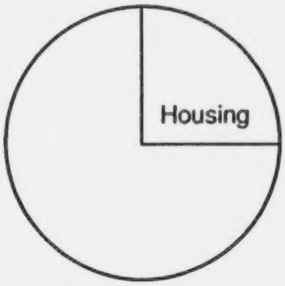
Worksheet 1: Percentages and pie graphs
Worksheet 2: Expressing numbers as percentages
Worksheet 3: Finding a percentage of a number
Worksheet 4: 10%

See below for a discussion of each Worksheet.

Worksheet 1: Pie Graphs

Pie graphs or circles are useful for showing fractions and percentages; the whole pie represents **everything** ie. **one** when working with fractions, or **100%** when working with percentages. Halves and quarters are easily made and students could even make rough pie graphs of other percentages. Drawing accurate pie graphs is beyond this level.

Draw a pie graph to show that 25% of a family's income is spent on housing.



Now ask students some questions about the pie graph:

- *What's good about pie graphs?*
- *What percentage is the whole pie?*
- *What percentage of income is spent on things other than housing?*

After the calculations, use the pie graphs on the Worksheet for a discussion. Here are some possible questions you could ask:

- *How many in this group eat rice every day? What is the main food of the rest of the group?*
- *Are you surprised about the pie graph for water use? Would this change in winter compared with summer?*
- *Is there anything unexpected about the use of the East Gippsland tree? Where is East Gippsland?*
- *How can you reduce fat in your diet? What foods are carbohydrates? Why eat protein? What are high protein foods?*
- *What do you consider to be exercise? Who exercises in the group?*
- *What is oxygen used for? (breathing)*

Students may like to find some pie graphs themselves.

Worksheet 2: Writing numbers as percentages

Give an example, writing it on the board:

100 people were in a survey
50 of these were born overseas
5 were disabled
all were over 21
none have done 12 years at school
quarter of them do not have a job

Go through each category and write the percentage in each case.

Now do **Worksheet 2**, working as a group or in pairs so that discussion can take place.

Worksheet 3: Finding a Percentage of an Amount

Give an example:

A fruit drink is 25% pure fruit juice

- *What is 25%?* (a quarter)
- *How much of a glass is fruit juice?* (a quarter)

Remind students that 50% means half, 25% a quarter, 75% three quarters, 100% all, 0% nothing.

Do **Worksheet 3** together or in small groups.

Worksheet 4 : 10%

Discuss with students the use of 10% in everyday life, eg. layby, discounts.

10% is one tenth; so to find 10% you divide by 10.

To find 10% of an amount of money, divide by 10.

eg. Judith puts a coat costing $90 on layby. She has to leave a deposit of 10%. How much deposit does she pay?
10% of $90 means 90 divided by 10, ie. $9.

Try some further examples and remind students that to divide by 10, cut off a zero.

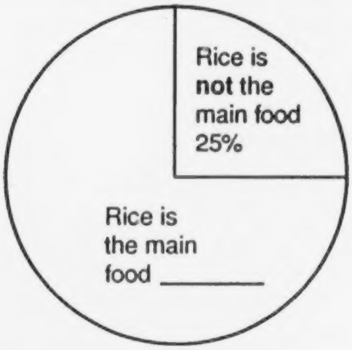
eg. 10% of $5
is 500c divided by 10 ie. 50c
(or do it on the calculator)

When working out 10% it is easier to divide by 10 rather than take 10c in every $1 (the method mentioned in the Introduction to Percentages).

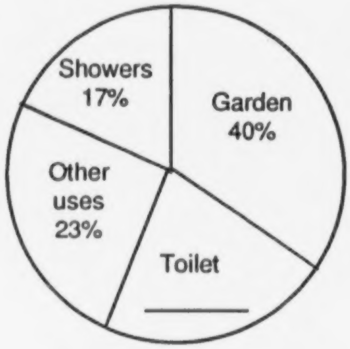
PERCENTAGES — Pie Graphs

Worksheet 1

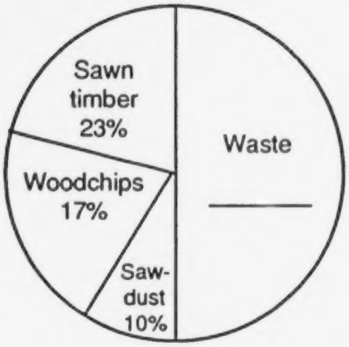
Find the missing percentage:



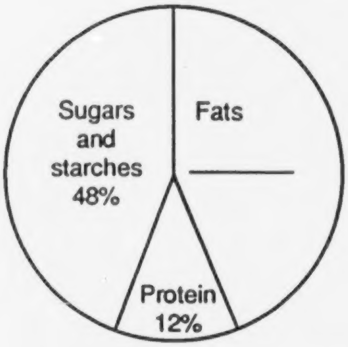
The World's Population



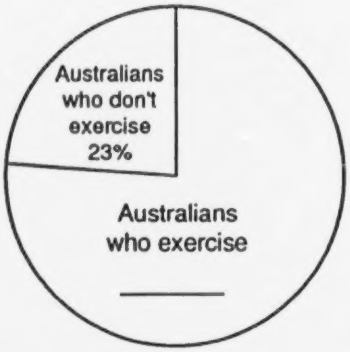
Household Water



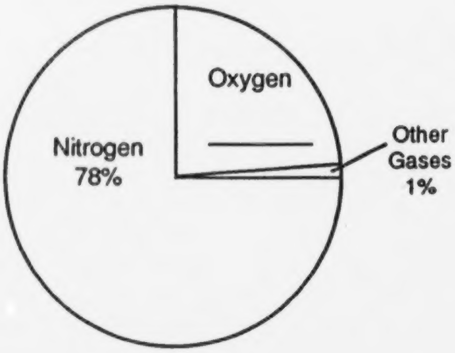
Use of East Gippsland Tree



Recommended Diet (Australians have about 38% fat in their diet)



All Australians



Gases that make up air

1991 Strength in Numbers: Goddard, Marr, Martin

PERCENTAGES
Writing Numbers as Percentages

Worksheet 2

Write a percentage for each of these.

1. Vince pays 49c income tax in the dollar. His tax is ....%.

2. 12 out of 100 audlts could not find a street intersection on a road map.

3. In 100kg of garbage there was 10kg of plastic.

4. A quarter of women in Australia have never married.

5. Half of all Australian women are in paid work.

6. A baby is three quarters water.

7. This jumper is pure wool.

8. One in five Australians own a dog. What percentage is this?

9. A person did not have any alcohol at a party. What % is their blood alcohol?

10. A dress shop bought a skirt for $60 and sold it for $120. What percentage did the shop add to the price?

PERCENTAGES

Worksheet 3

Finding a Percentage of an Amount

1. There are 8 people in Maria's class. There was 100% attendance in a class on Monday. How many came on Monday?
   On Friday there was 50% attendance. How many were there on Friday?

2. Ida has a loan for $500 at 25% interest each year.
   How much interest does she pay in a year?

3. Watermelon is 90% water.
   How many grams of water do you buy in each kilogram of watermelon?

4. The Anti Cancer Council found that 20% of Victorians are sunburnt every weekend in summer.
   Out of 1000 in a small town how many are sunburnt?

5. In a survey it was found that Australians spent nearly 25% of their food budget on eating out or takeaways.
   How much is this out of a $40 food budget?

PERCENTAGES **Worksheet 4**
10%

1. What is the deposit on each of these if you pay 10% deposit?

$350
$500
Car for $6000

*$58
*$79
*$105

*(use a calculator)

2. SALE
10% DISCOUNT

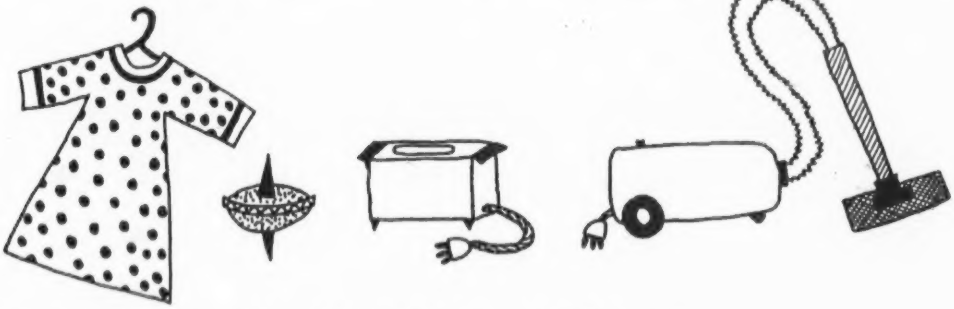
What is the discount? How much do you pay?

$50 dress Discount _______ You pay ___________

$10 toy Discount _______ You pay ___________

$60 toaster Discount _______ You pay ___________

$300 vacuum cleaner Discount _______ You pay ___________



3. Prices went up 10%. Add 10% to each of these:

$10 new price ________

$50 new price ________

$300 new price ________

$1000 new price ________

50c new price ___________

$2 new price ___________

$5 new price ___________

FRACTIONS AND PERCENTAGES Answers

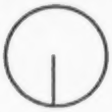
FRACTIONS OF A WHOLE
Worksheet 2

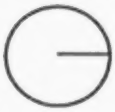
2. 1/6, 2 pieces   3. 1/4, 1/2, 3/4
4. 8 pieces, 1/8, 5/8   5 1/5, 2/5

Worksheet 3

1. 1/4   2. 1/4, 1/2, 3/4

Worksheet 4

1.


2.


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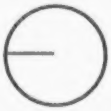
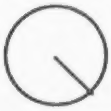
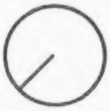


4.

1/3 of an hour

5.

2/3 of an hour

DOING THINGS WITH FRACTIONS
Worksheet 1

$1.10 $0.55 $0.90

Worksheet 2

1. 3/4   2. 30L   3. 10L
4. 20L   3. 10L   6. 1/4

Worksheet 3

1. 300 km   2. Euroa   3. 1 3/4 hours   4. 2/3

Worksheet 4

1. $175   2. $135   3. 1/4   4. $9,000

Worksheet 5

1. 12 children   2. 1/2 roll   3. 3 rolls
4. 3 rolls   5. 1/3

FRACTIONS AND PERCENTAGES Answers

FRACTIONS OF A WHOLE

Worksheet 6

1. 6 eggs
2. 3 eggs
3. 1/3
4. 9 eggs
5. 18 eggs

Worksheet 7

Zone 1: 70c

Zone 2: 45c

Zone 3: 45c

1 adult and 2 children in Zone 1 costs $2.80.

Worksheet 8

1. 10.45 am
2. 3/4 hour
3. 15 mins, 30 mins, 45 mins
4. 1/3 hour, 2/3 hour
5. 6 months
6. 1.45 pm
7. 6.45 am

Worksheet 9

T-shirt:	$10
Jumper:	$22.50
Shirt:	$15
Jeans:	$45
Board shorts:	$18

Worksheet 10

1. 3 cups flour
   big pinch salt
   2 teaspoons spice
   1 1/2 cups butter
   1/2 cup sugar
   1 cup walnuts
   2/3 cup raisins
   2 beaten eggs
   1 cup milk
2. 2 cups milk powder
   1/2 cup milk powder
   4 cups milk powder
   1/4 cup milk powder
3. 1 cup bleach
   2 cups bleach
   6 cups bleach

Worksheet 11

32 triangles; 16 spotty triangles; 1/2 the quilt is spotty

1/2 the quilt is striped

FRACTIONS AND PERCENTAGES Answers

THE MEANING OF PERCENT Worksheet 1

One dollar: 50% = 50c 100% = $1.00 25% = 25c
10% = 10c 75% = $ 75c 0% = 0c

PERCENTAGES - PIE GRAPHS Worksheet 1

Rice is the main food: 75%
Toilet: 20%
Waste: 50%
Fats: 40%
Australians who exercise: 77%
Oxygen: 21%

PERCENTAGES - WRITING NUMBERS AS PERCENTAGES Worksheet 2

1. 49%
2. 12%
3. 10%
4. 25%
5. 50%
6. 75%
7. 100%
8. 20%
9. 0%
10. 100%

PERCENTAGES - FINDING A PERCENTAGE OF AN AMOUNT Worksheet 3

1. 8, 4,
2. $125
3. 900 grams
4. 200
5. $10

PERCENTAGES - 10% Worksheet 4

1. $35 $5.80
$50 $7.90
$600 $10.50

2. Discount $5 You pay $45
Discount $1 You pay $9
Discount $6 You pay $54
Discount $30 You pay $270

3. $11
$55
$330
$1,100
55c
$2.20
$5.50